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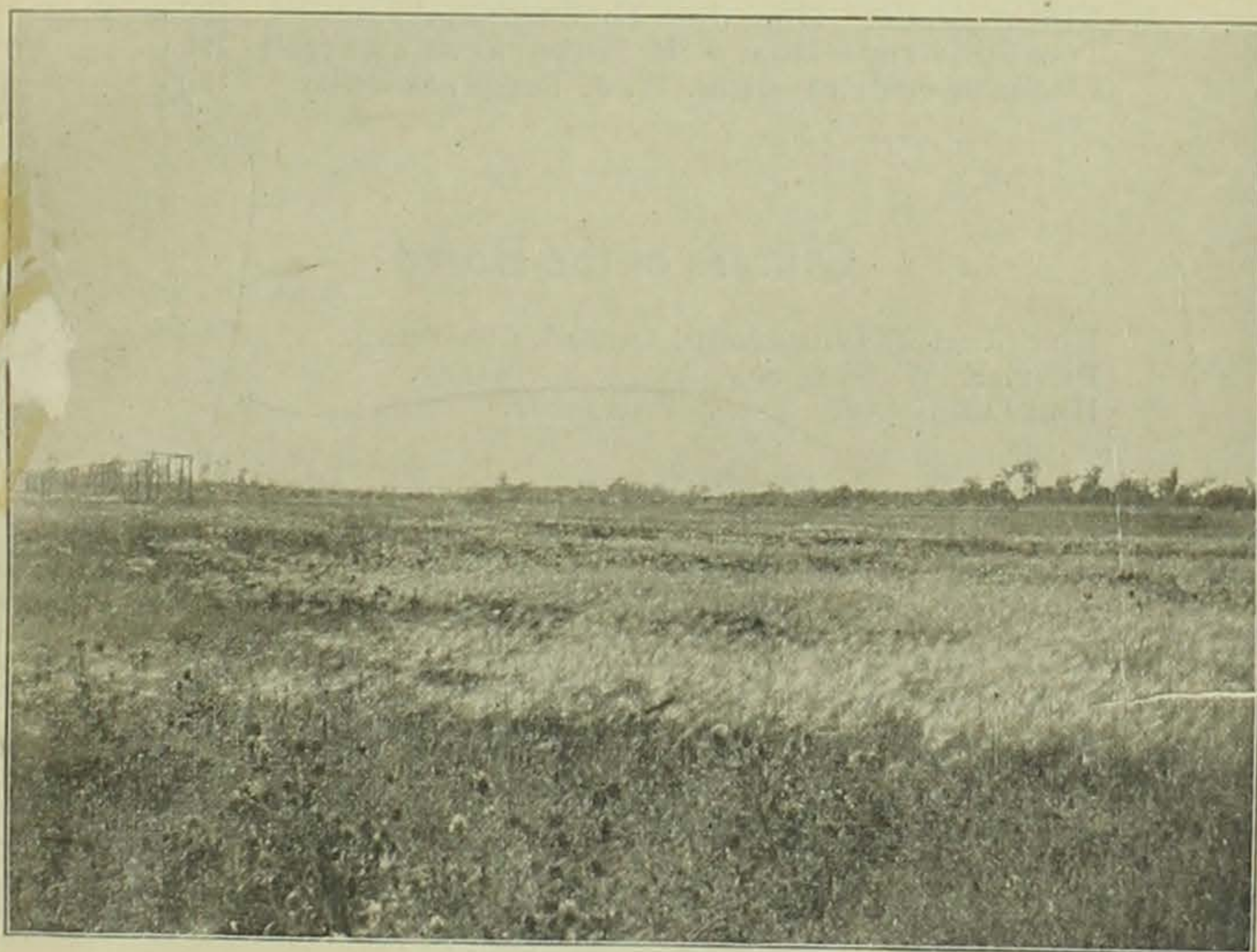


BULLETIN 70

DECEMBER, 1903

# EXPERIMENT STATION

IOWA STATE COLLEGE  
OF  
Agriculture and the Mechanic Arts  
AMES, IOWA



BOTANICAL SECTION

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SOME WEEDS OF IOWA

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PRESS OF  
THE AMES TIMES  
AMES, IOWA



IOWA  
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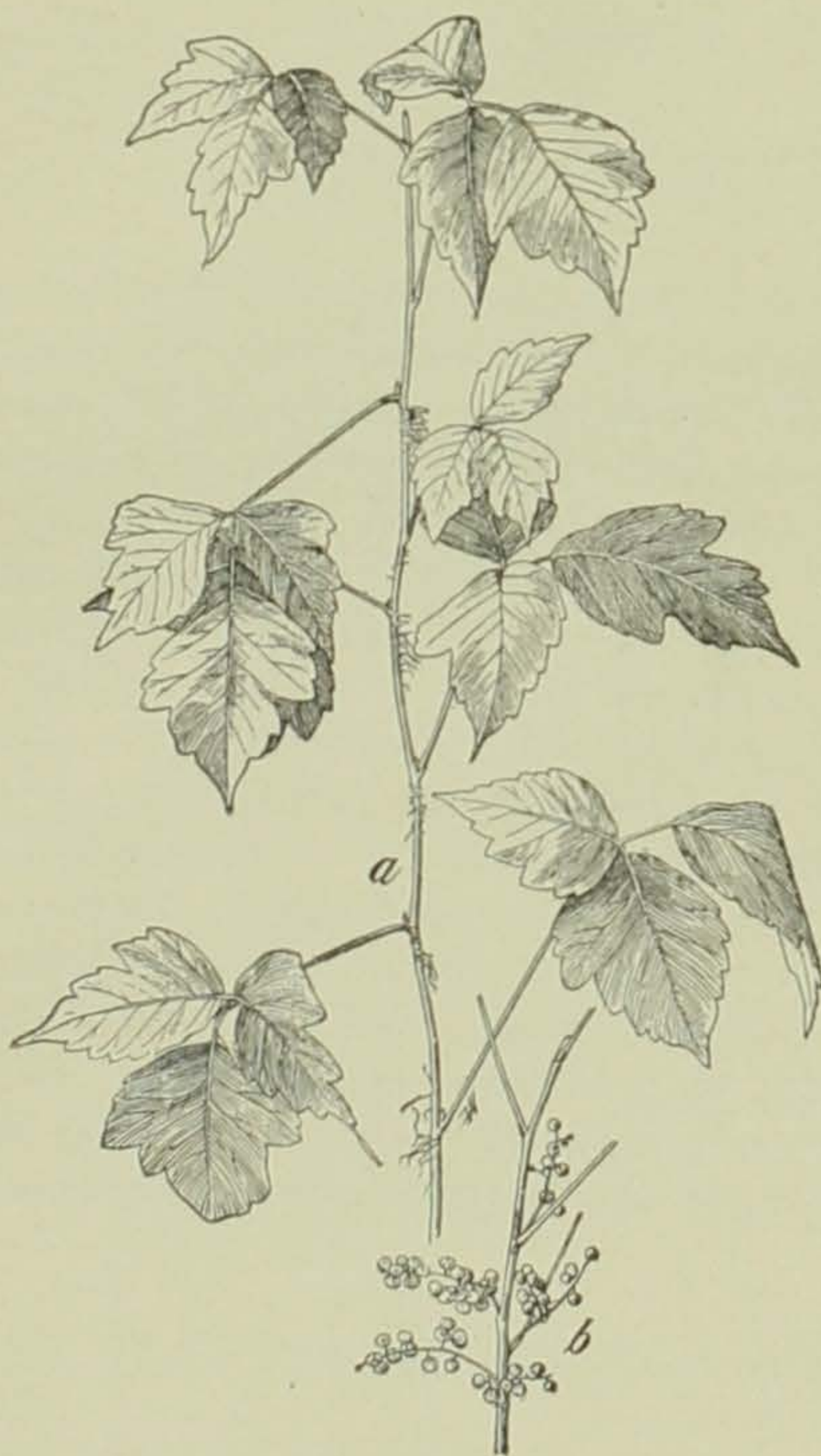
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# ERRATA



This cut takes the place of figure 103 on page 445

Omit Heading—THE WEEDS OF TWO GARDEN PATCHES  
COMPARED, on page 466.



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# SOME WEEDS OF IOWA

BY L. H. PAMMEL

## INTRODUCTION.

During the year the Department of Botany receives a great many requests for information on the subject of weeds. These requests come from all parts of the state. Many different kinds of plants are sent in. Some of course, more frequently than others. The writer at different times has given accounts of weeds in the Experiment Station Bulletins. Most of these bulletins are now out of print. It seems advisable, therefore, to re-issue a limited edition to supply the demand for information on this topic. In addition to this we have given a somewhat comprehensive account of the migration of weeds and the dissemination of plants. We have likewise included an account of some poisonous plants, inasmuch as several cases of poisoning from Cowbane occurred during the present spring season. It is our purpose later to publish a more extended account of weeds, especially on many points pertaining to the vitality of weed seeds, their extermination, distribution, etc. In order to answer some of the many queries this bulletin is published.

## INJURIOUSNESS TO CROPS.

An enormous amount of labor is involved every year in the extermination of weeds. Not only are these weeds troublesome to cultivated agricultural crops but they are troublesome in meadows and pastures. The corn fields and cultivated crops generally must be kept clean if a crop is to be produced. Of course, the farmer would want to till his soil whether weeds occurred or not. A soil that is not cultivated would not produce a remunerative crop. But the weeds have come to stay and the farmer must till the soil to keep the weeds in subjection. It is therefore important that every farmer should know something of the best methods of exterminating these weeds and thus make it possible to produce larger and better crops.



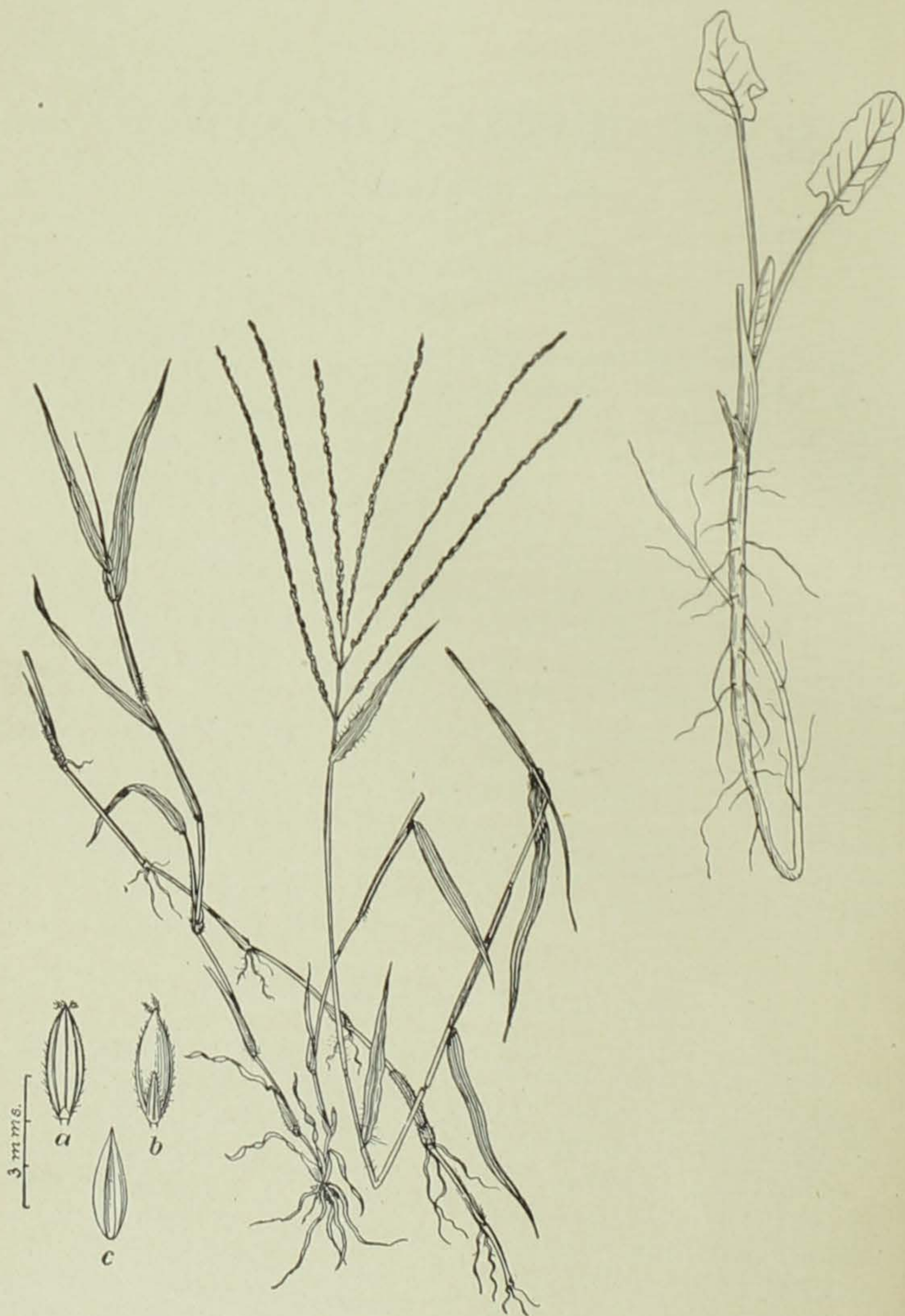



Fig. 1. CRAB GRASS (*Panicum sanguinale*), an annual weed. (Division of Agrost. U. S. Dept. of Agriculture).  
 Figure 2. BURDOCK (*Arctium Lappa*), a biennial weed, native of Europe. (Charlotte M. King).



## DURATION OF WEEDS.



*Annual Weeds.*—The seeds of annual weeds germinate in the spring produce flowers and seeds the same season and this ends their existence. Foxtail (*Setaria viridis*), ragweed (*Ambrosia trifida*), smartweed (*Polygonum Pennsylvanicum*) are illustrations. These produce an abundance of seed. The annual class varies greatly; some of the annuals approach the biennials, and are known as winter annuals. Seeds of these germinate in the fall, produce a good growth of radical leaves, live through the winter, and, if the season happens to be a favorable one, may grow during mild weather; on the appearance of warm weather in the spring, these plants grow rapidly, some flower and produce seed, and then die. Prickly lettuce, squirrel-tail grass, all most noxious weeds, belong to the class of winter annuals. The annuals differ in regard to their pertinacity. Shepherd's purse is easily subdued; crab grass is not so easily destroyed, since it strikes root so easily at the nodes; foxtails are easily subdued as individuals, but the chief difficulty is that these plants seed so abundantly that the soil contains myriads of seed, a large number of which are ready to take the place of those that have been destroyed. Some of these winters annuals, like the prickly lettuce, when cut off above the surface of the ground, send up a number of branches; these flower in a short time, and where there was only a single stock before there may now be a dozen.

*Biennial Weeds.*—These are not conspicuous in cornfields for the reason that the young plants are destroyed in cultivation. Biennial plants produce only vegetative organs the first season; in many of these a rosette of leaves spreads over the ground; the second season a flower stem is thrown up. This bears flowers and seeds. As an illustration, bull thistle (*Cnicus lanceolatus*). Mullein, burdock, parsnip and carrot are other illustrations. The biennial weeds are conspicuous examples in fields that are poorly plowed. These are likely to crop out in fields where the plan is adopted to run through with the cultivator. Biennial weeds will not appear where the ground is properly plowed. Nevertheless, these weeds may appear on the borders of the field and in fence corners. We have here a most conspicuous example in the bull thistle.

*Perennial Weeds.*—These weeds live for a considerable time. The plant produces underground stems. These send up stalks and in turn produce flowers and seed. When cut, new flowering stems are produced. The weeds of this class cannot be



removed by simple cutting off the stems below the ground. As an illustration of this class, morning glory (*Convolvulus sepium*), milkweed (*Asclepias cornuti*) and horse nettle (*Sola-*



Figure 3. CANADA THISTLE (*Cnicus arvensis*), one of the perennial weeds. (Photo by Charlotte M. King).

*num Carolinense*) may be cited. The weeds of this class do not depend for their existence on seed production, as is evidenced by the horseradish, which has continued to propagate in this country without seeds. Other weeds of this class are largely extended by their root propagation. Indeed, as a general thing, many of the most troublesome weeds of this class are not so seed productive.

## WEEDS OF SPECIAL CROPS

### WEEDS OF CORN FIELDS.

The weeds found in corn fields annually cost the farmer of Iowa many thousands of dollars. To clean the field of weeds requires constant care from the time corn is put in till it is



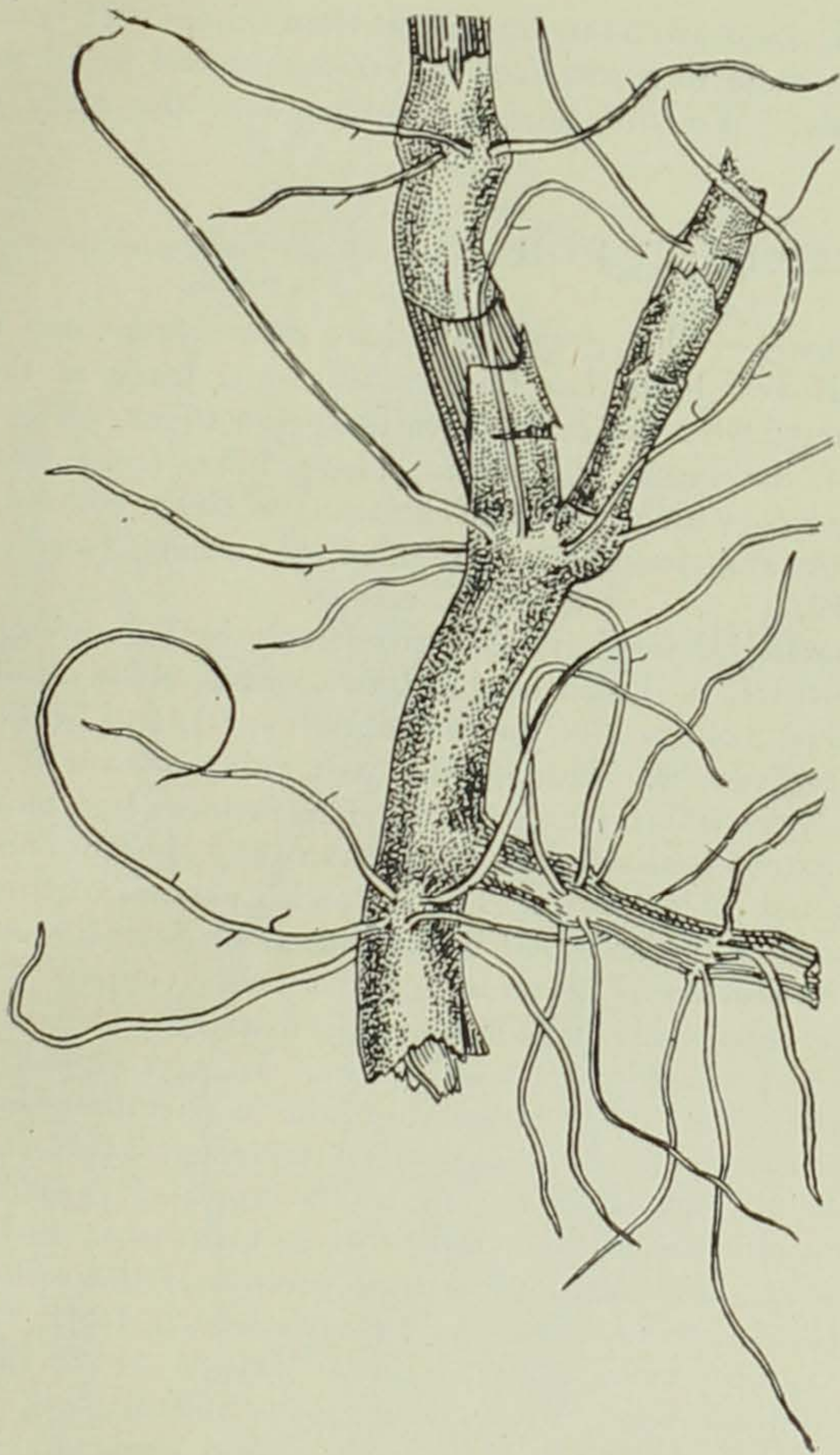


Figure 4. ROOTSTOCK OF MARSH SMARTWEED (*Polygarum Muhlenbergii*) (Charlotte M. King).

"laid by." Much will depend on the condition the crop was left in the previous season. If the field was kept clean much less labor would be involved than where weeds were allowed to grow. Much will depend also on the weeds that are allowed to grow unchecked in the fence corners or along the roadsides. For these are the source of spreading the weeds. Clean culture shows thrift and success as a farmer. Of the weeds found in



corn fields, some are more important than others. It is difficult to arrange them in a satisfactory manner suited to all sections of the state. We will begin therefore with the early spring weeds.

NORTHERN NUT GRASS.—(*Cyperus esculentus*, L.)

*Description.*—This grass-like plant grows from one to two and a half feet high, has triangular stems, leafy at the base when young; later the leaves terminate the stems. The spikes consist of numerous spikelets. These have from twelve to thirty flowers, which are light chestnut or straw colored. The scales of the spikelets are rough margined; achene (seed) longer than broad.

This perennial weed spreads extensively by its underground, nut-like tubers, as shown in the figure. It is closely related to the southern nut grass (*Cyperus rotundus*, L.), and in the north entirely replaces it. During the past rainy season it was in evidence every where in the state. The farmers had more difficulty in exterminating this weed than any other one plant that they had to deal with. The yellowish patches of this grass-like plant could be observed in passing along farms, along railroads in all section of the state that the writer visited. In Iowa *Cyperus esculentus* is quite universally distributed. It has been observed and noted in Iowa as follows. In part represented by specimens in the college herbarium and in part based on notes furnished me by R. I. Cratty, of Armstrong, Iowa; *Cyperus esculentus* L., cosmopolitan; in North America ranging from New Brunswick to Florida and west to California and Texas. Iowa, central, southern and eastern portion of the state; Iowa City and Ames, 1889, Hitchcock; Marshalltown, 1891, Stewart; Fayette county, 1893, Fink; Clinton county, 1896, Pammel; Clayton county, 1895, Fitzpatrick; Scott and Muscatine counties, where it is quite frequent in cultivated lands, Barnes and Miller. It is more abundant in low grounds; especially common about Clinton, Des Moines, Ames and Missouri Valley. Prof. Henry of the University of Wisconsin, some years ago, made inquiries in regard to weeds in that state. This weed was sent to him frequently. This sedge is most troublesome in early spring. The fields where it is common have a yellow color.

This sedge is replaced in the south by the southern nut grass (*Cyperus rotundus*) which does not occur in the state. Our species is quite as troublesome as the southern nut grass.





Figure 5. NORTHERN NUT-GRASS (*Cyperus esculentus*) A very common weed in low grounds. (Charlotte M. King).



*Extermination.*—This weed can only be exterminated by thorough cultivation. Running the harrow over the field when corn is young will not exterminate the weed. The little offshoots only sprout again giving rise to many more plants. Running the cultivator through the field is more effective, but not sufficient. In bad fields it will be necessary to use the hoe.

## WEEDS OF THE GRASS FAMILY

Weeds of this family make their appearance early in the season, especially the foxtails and crab-grasses. The former appearing nearly as early as the Northern nut grass. They are produced continuously during the season. The young plants of the first crop are generally destroyed, to be followed by another crop of plants, or such as were not killed by the first cultivation.

Few members of the grass family are conspicuous among the weeds of corn fields. The most conspicuous weeds of this family are green foxtail, bottle grass, pigeon grass (*Setaria viridis*), foxtail or pigeon grass (*Setaria glauca*), bristly foxtail (*Setaria verticillata*), crab grass or finger grass (*Panicum sanguinale*), and barnyard grass (*Panicum crus-galli*), sandbur (*Cenchrus tribuloides*), drop seed or nimble Will (*Muhlenbergia Mexicana* and *M. glomerata*), tickle grass (*Panicum capillare*), stink grass (*Eragrostis major*, *E. Frankii*, and *E. Purshii*).

Of these grasses the foxtails, are the most serious, occurring in every part of the state. Barnyard grass occurs in low grounds. The finger grass is most abundant in the southern and eastern portions of the state, becoming more frequent. The drop seed grasses are widely scattered throughout the state, especially the Mexican drop seed grass. The sandbur is common only in sandy soil or flood plains of some of our streams.

### FOXTAIL.—(*Setaria glauca*, Beauv.)

*Description.*—An erect annual one to two and one-half feet high, flat leaves, bristly cylindrical spike, from one to three inches long. The heads are slender and the bristles tawny yellow. The small seeds of this species are conspicuously cross-striated and are easily distinguished from the next species because of its larger size and by its cross striation. This species also comes up in grain fields after harvest, hence seeding the soil abundantly.





Figure 6. YELLOW FOXTAIL (*Setaria glauca*). (Division Agrost. U. S. Dept. of Agriculture).

*Distribution*.—Maine, Connecticut, New York, to Florida; Alabama, Texas, Arkansas, Mexico, Colorado, Iowa, Minnesota, Missouri, Nebraska, the Dakotas, Wisconsin, New Brunswick, to Saskatchewan, the Rocky Mountains and Pacific coast.

This species is widely distributed in all parts of this state; introduced by the early settlers. It is common not only in the eastern states and the Mississippi valley but also in the Gulf region, Rocky mountains and California. Generally a troublesome weed.

GREEN FOXTAIL.—(*Setaria viridis*, Beauv.)

*Description*.—An erect annual from one to three feet high,



leaves four to twelve inches long with rough margins, greenish, more or less compound cylindrical spikes from one to five inches long or even in some cases six. Bristles few, much longer than the spikelets. Spikelets one-twelfth of an inch long, the chaff (second and third glumes) as long as the minute chaff (fourth glume), the latter being dotted and striate. A single head



Figure 7 GREEN FOXTAIL (*Setaria viridis*). (Division of Agrost. U. S. Dept. of Agriculture.)

produces an enormous number of seeds. These seeds appear to have considerable vitality. Cultivated ground is thickly seeded, hence it is almost impossible to remove the weed. When fields are sown to oats this plant comes up in the fall and late summer, seeding the soil.

*Distribution.*—From Nova Scotia to Maine, New York, Con-



necticut, New Jersey, District of Columbia, south to Florida; Alabama to Texas and Mexico, north to Utah, Colorado, the Dakotas, and eastward, also Manitoba and Saskatchewan. Green foxtail is a native of Europe, and is very common throughout the state of Iowa. Introduced by the early settlers and from thence has spread to vacant ground, abundant in fields everywhere.

BRISTLY FOXTAIL.—(*Setaria verticillata*, Beauv.)

*Description*.—An annual from one to two and a half feet high with leaves from two to seven inches long, somewhat narrower than the preceding, from one-fourth to one-half inch wide, sheaths, smooth, rough on the margins and veins, spike cylindrical, from one inch to four and one-half to five inches long, composed of short cylindrical clusters, bristles short, a little longer than the spike. The bristles shorter, single or in pairs, barbed downward. The seeds are small, greenish, one-eighth of a line long, minutely cross-striated and wrinkled.

*Distribution*.—From New England, New Jersey, to Virginia, Alabama, Texas, Mexico, to Missouri, Illinois, Iowa and Nebraska; Nova Scotia to New Brunswick and Ontario.

Bristly foxtail has become quite troublesome in some of the southern states, also abundant in southern Iowa. In the course of time the species will no doubt be quite as troublesome as the other two species. It is much more easily disseminated by animals because of the downwardly barbed bristles.

*Extermination of Foxtails*.—The foxtails are annuals and hence it ought to be an easy matter to destroy them. They produce an enormous amount of seed. Mr. G. M. Lummis estimated that a good sized plant of *Setaria viridis* had 2,500 to 5,000 seeds and *Setaria glauca* 1,000 to 5,000 in each case; this is the progeny of a single seed.

Where these grasses are so abundant the ground becomes thickly covered. The seed also retains its vitality for a considerable length of time. Dr. Beal of the Michigan Agricultural College has found that the seed retains its vitality for a considerable length of time. In six years 21 seeds out of 50 ger-

Proc. Soc. of Prom. Agrl. Sci. 6: 14. In the autumn of 1879 Dr. Beal placed the seeds of a number of weeds in pint bottles, leaving them uncorked in the sandy soil. After the lapse of five years twenty-six per cent germinated in 1884, and 42 per cent in 1885.



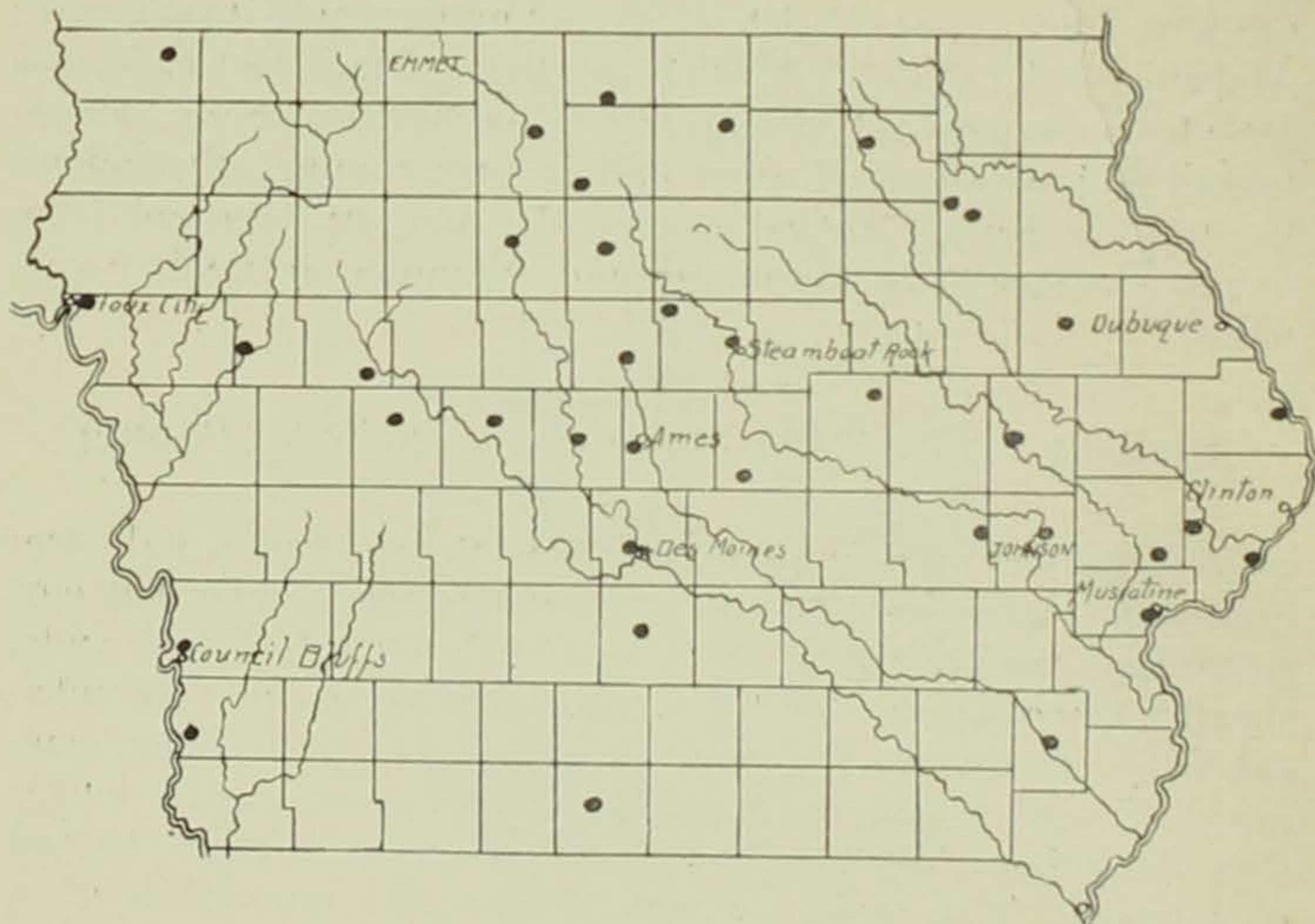


Figure 8. GREEN FOXTAIL (*Setaria viridis*). (From specimens in the herbarium, Iowa State College).

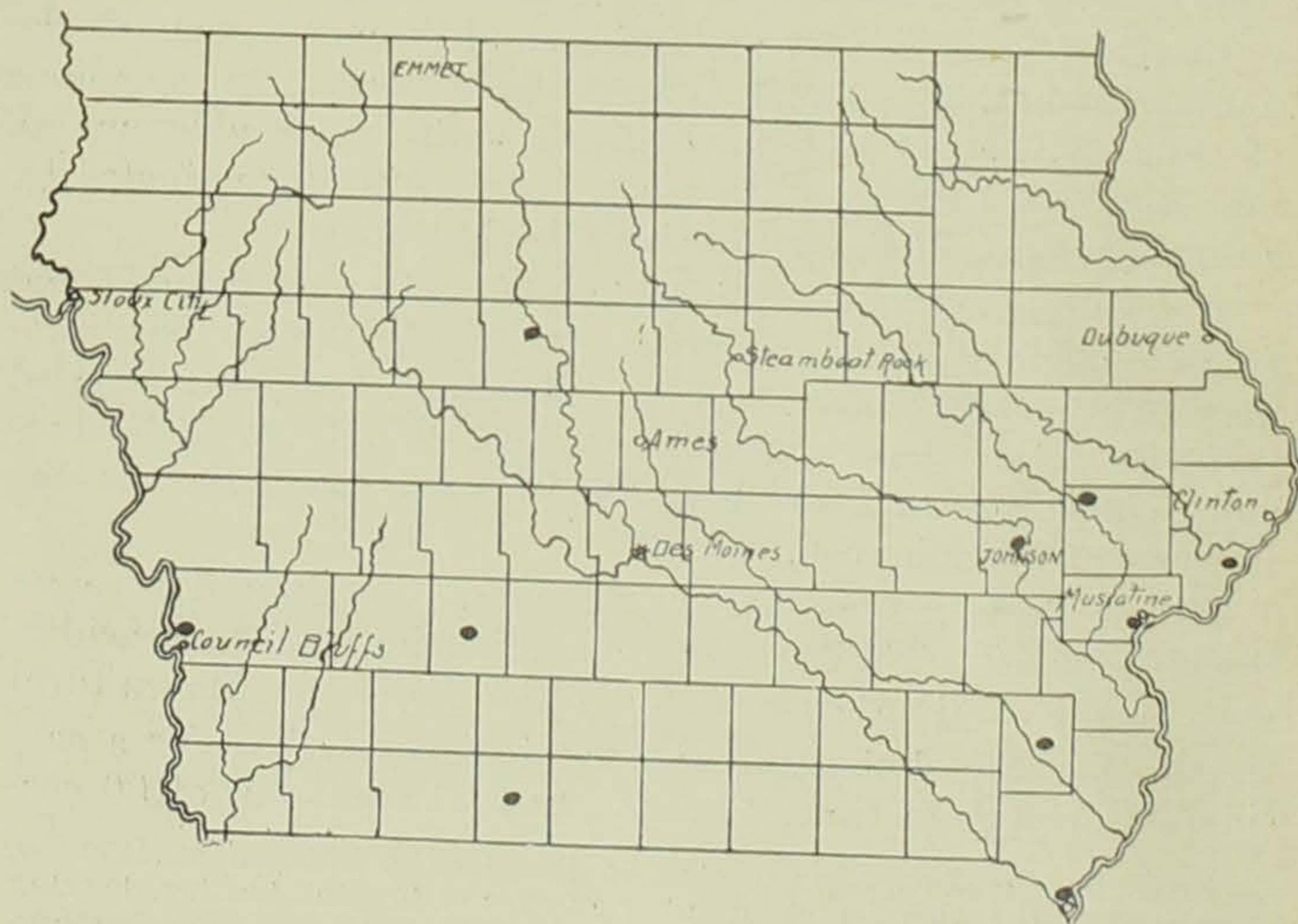


Figure 9. BRISTLY FOXTAIL (*Setaria verticillata*). (From specimens in the herbarium, Iowa State College.)



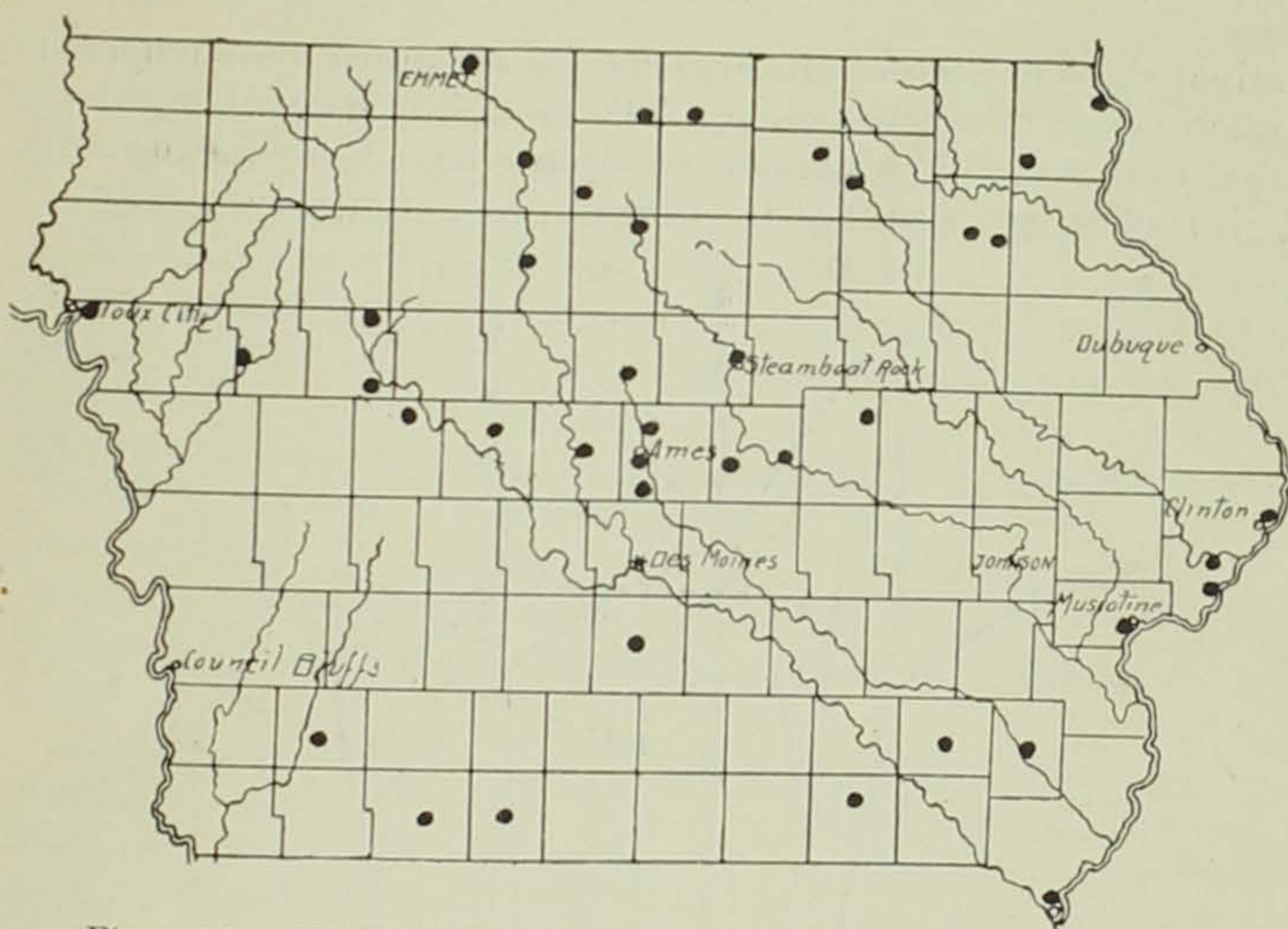


Figure 10. PIGEON GRASS (*Setaria glauca*). (From specimens in herbarium, Iowa State College.)

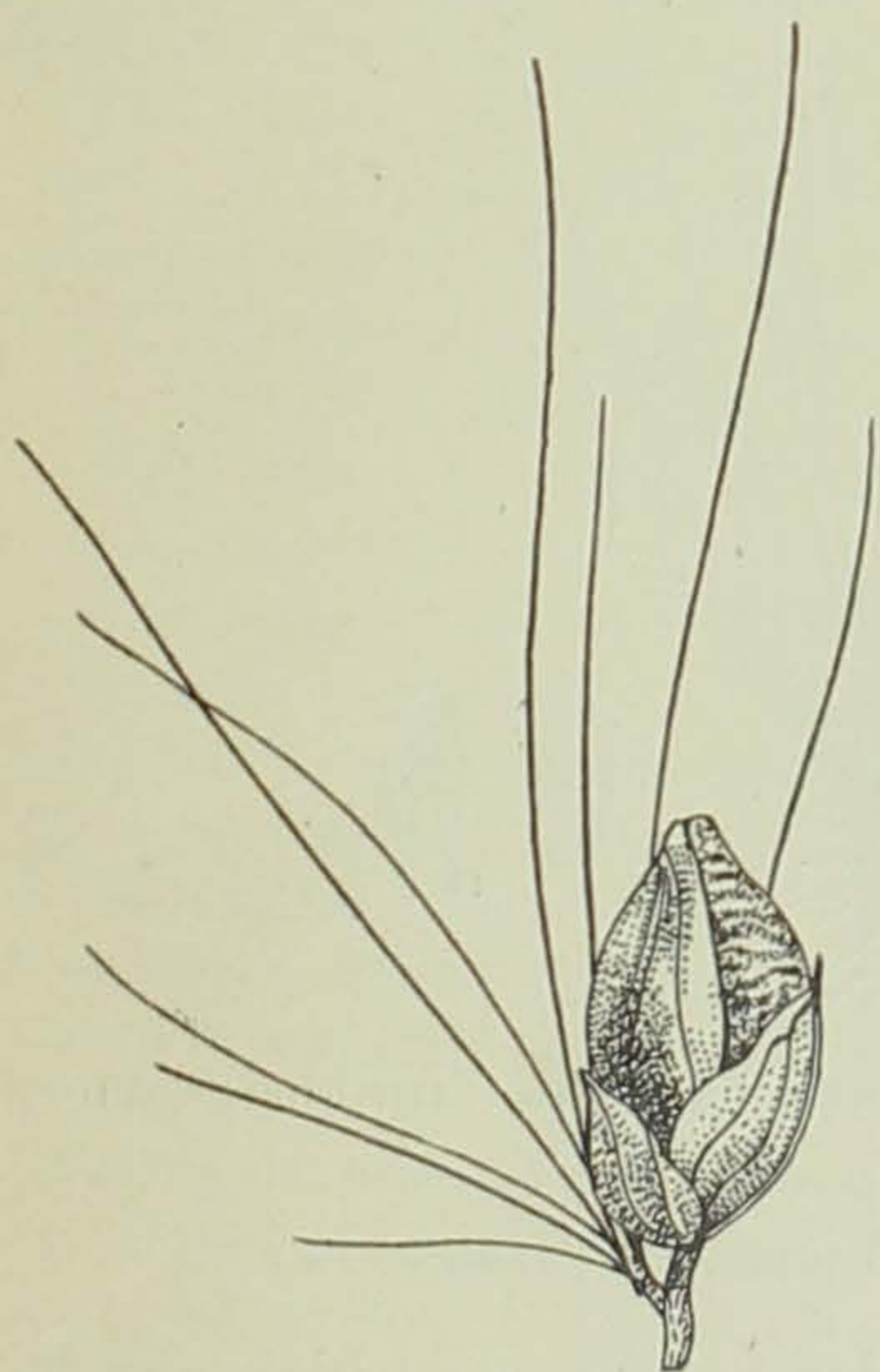


Figure 11

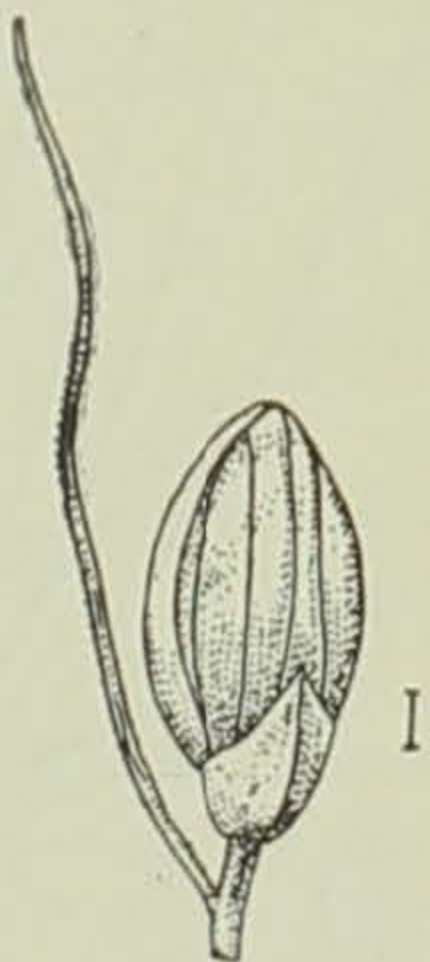


Figure 12



Figure 13



Figure 14

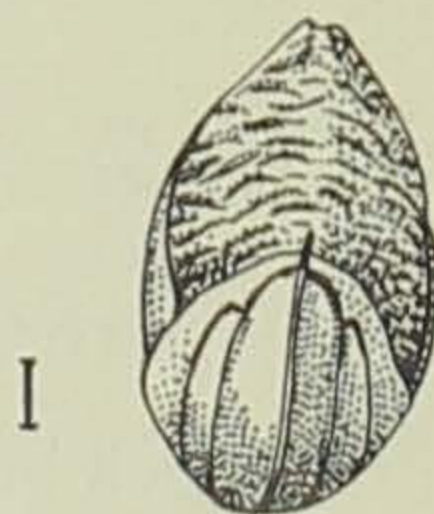


Figure 15

11—"Seeds" of (*Setaria glauca*). 12—"Seeds" of Green Foxtail (*Setaria viridis*).  
13—"Seeds" of Bristly Foxtail (*Setaria verticillata*). 14—Crab Grass (*Panicum sanguinale*). 15—"Seeds" of Foxtail (*Setaria glauca*).



minated. The seed of all three species are much more tenacious when young than when older. The ground is covered so thickly that only some of the plants are destroyed. Covering up with soil is effective as well as exposing the roots to the sun.

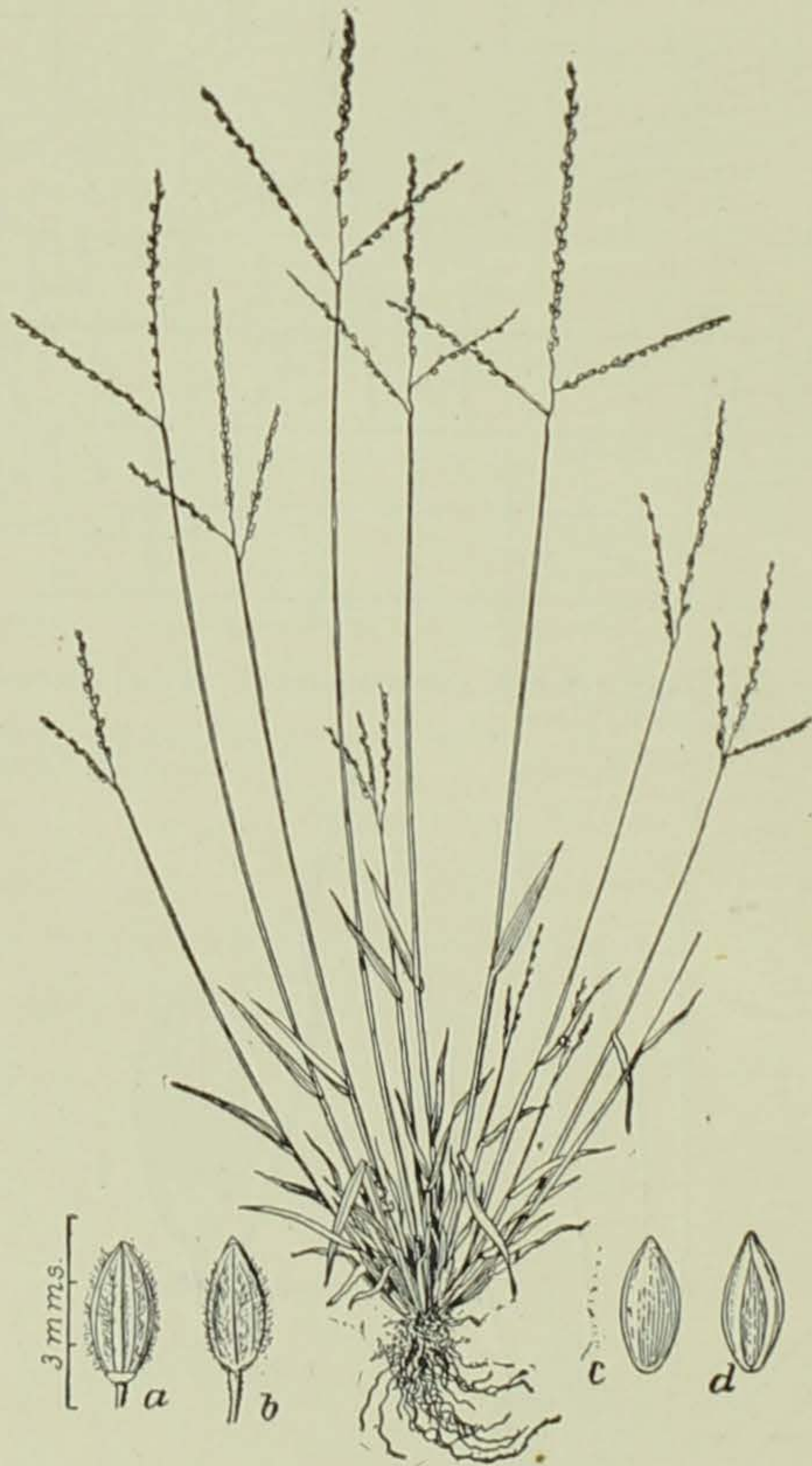


Figure 16. SMOOTH CRAB GRASS (*Panicum glabrum*). (Division of Agrost., U. S. Dept. of Agriculture).

#### FINGER GRASS.—(*Panicum sanguinale*, L.)

A much branched, leafy annual one to three feet high, spreading on the ground, with erect, smooth, spreading culms, frequently rooting at the lower joints. Joints smooth, though more frequently bearded with deflexed hairs. Sheaths loose, generally pi-



lose, hairy, ciliate on the margins, with a membranaceous ligule. Leaves two to four inches long with rough margins, occasionally pilose at the base. Flowers produced in digitate spikes hence the common name finger grass. Spikelets less than one-eighth of an inch long in pairs, one nearly sessile the other with a stalk. Each flower consisting of two sterile glumes (chaff) and the flower proper. The first bract very small, the second about one-half to two-thirds as long as the spikelet, usually hairy on the margin. The third glume somewhat longer than the fourth which is five nerved and usually silky-villous along the marginal nerves. Fourth glume smooth and acute. The fruit is minute, pitted and cross striated, light straw color except where the sterile glumes remain attached. These are gray in color and minutely hairy.

*Distribution.*—From New England, New Jersey, Connecticut, Maryland, North Carolina, Kentucky, Ohio, south to Florida, West to Missouri, Texas and M Rocky mountain region, Kansas, Nebraska, the Dakotas, Minnesota, Iowa, Wisconsin, Illinois, Missouri.

*Extermination.*—This grass is much more difficult to remove than the foxtails because it roots readily at the joints. Thorough cultivation will remove the weed. Do not allow it to go to seed. It is common in the bottoms along our streams, and is occasionally troublesome in corn fields. This species is, however, most conspicuous in lawns.

#### BARNYARD GRASS.—(*Panicum crus-galli*, L.)

This grass is abundant in low fields and frequently causes some annoyance in such situations.

*Description.*—A coarse ascending, leafy annual one to five feet high with wide leaves, spike one to three inches long, crowded in a dense panicle. Culms frequently branched near the base, sheaths loose, smooth or sometimes hispid. Leaves broad and flat, six inches to a foot or more long. Smooth or roughened, margin roughened, spikelets densely and irregularly crowded in several rows along one side of the spike-like branches of the panicle. Spikelets one and one-half lines long, outer glume or bract from one-fourth to one-half the length of the spikelets. Second and third glumes smooth, pubescent or hispid along the nerves. The fourth glume smooth, awnless or short awn pointed.

*Distribution.*—Maine, New Jersey to Florida; west to Georgia, Alabama, Texas; north to Tennessee, Illinois, Missouri, Wisconsin, Nebraska, Kansas, to the Rocky mountain





Figure 17. BARNYARD GRASS (*Panicum crus-galli*), (Division of Agrost. U. S. Dept. of Agriculture).

region, Mexico, (Gaudalajara, and Pacific Coast); Nova Scotia to New Brunswick.

*Extermination*.—Thorough cultivation and prevent the formation of seeds.

#### SMARTWEED.—(*Polygonum Pennsylvanicum*, L.)

The smartweeds are extremely common in cornfields. They are mostly annuals, one species is a perennial.

*Description*.—An annual; one to two feet high, with lanceolate leaves. The branches below the flowers are beset with numerous stalked glands; flowers whitish or rose colored; stamens, six to eight, style two cleft; the fruit is an achenium, popularly



called the seed, one and three-fourth lines long. It is flattened, brown, shining, part of the calyx remaining attached to the base. Cornfields are sometimes covered with it, though, when culti-

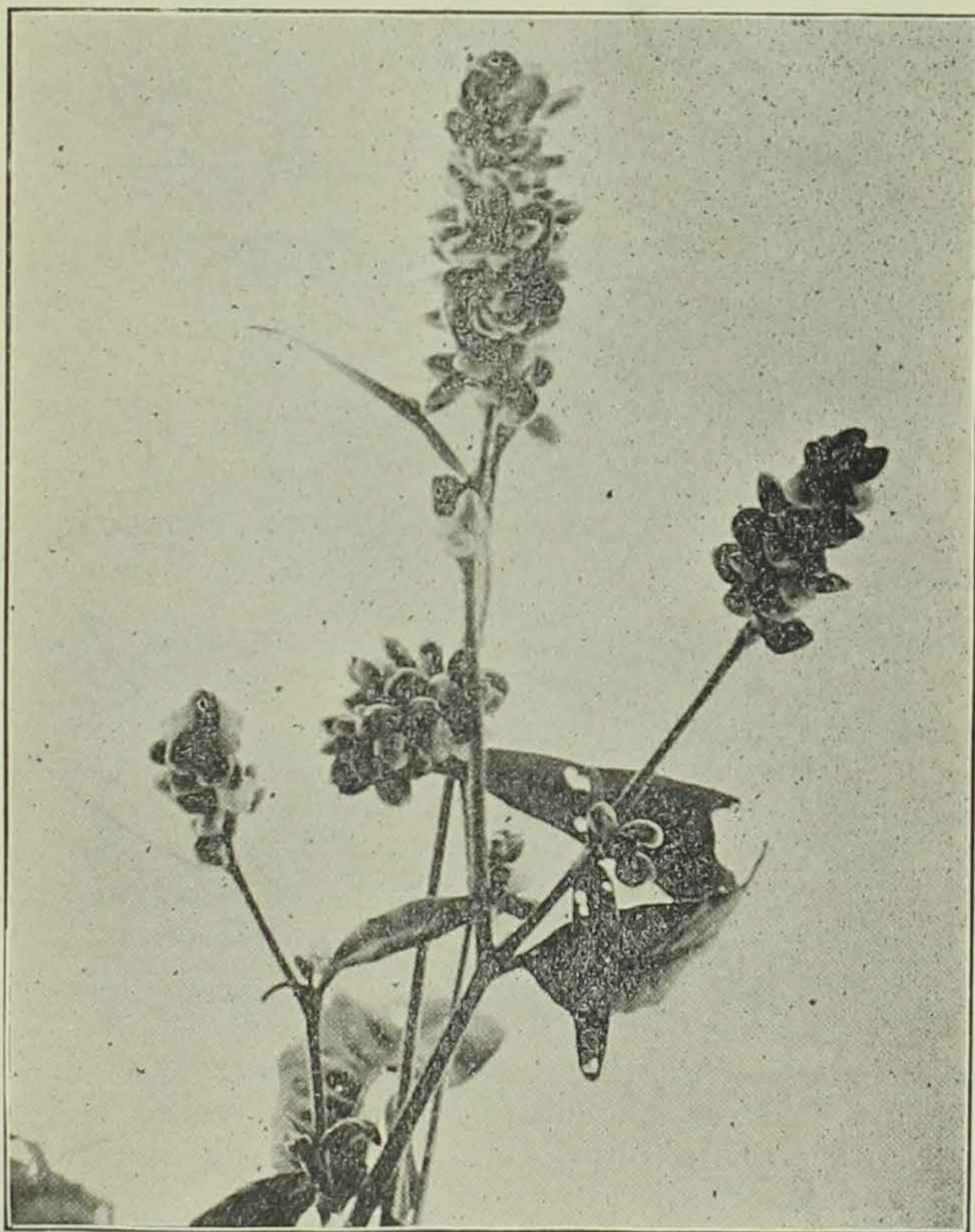


Figure 18. HEART'S EASE OR PENNSYLVANIA SMARTWEED (*Polygonum Pennsylvanicum*). (Photo by W. Newell).

vation is thorough, this weed need occasion little alarm. A closely related species, *P. lapathifolium* L. var. *incarnatum* Watson, is much taller, has longer spikes and smaller flowers, and is without the glands. This species is common in low grounds, especially so in northern Iowa.

*Extermination.*—Clean culture and prevent the formation of seeds.



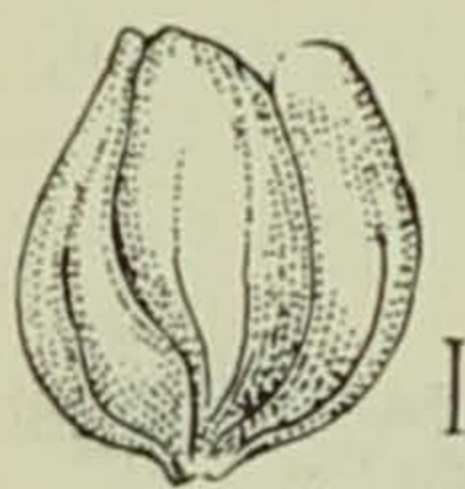


Figure 19

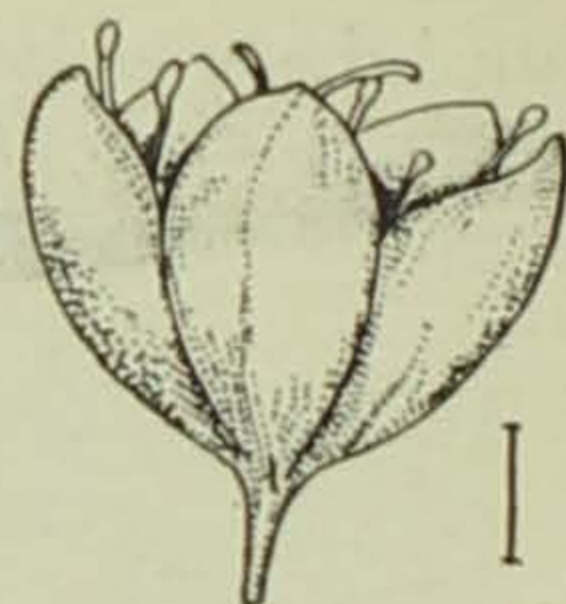
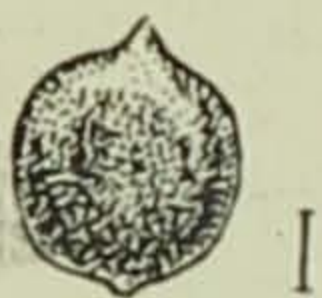


Figure 20



Figure 21

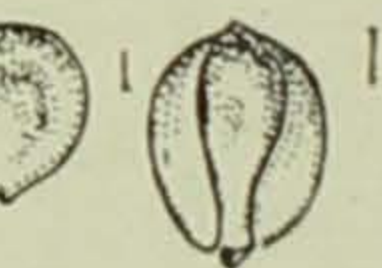


Figure 22

19—"Seeds" of Smartweed (*Polygonum pennsylvanicum*). Charlotte M. King.  
20—Flower of Marsh Smartweed. 21—Seed and flower of Marsh Smartweed.  
(*Polygonum mahlenbergii*). 22—Smartweed flower and seed (*Polygonum incarnatum*).

#### MARSH SMARTWEED.—(*Polygonum Muhlenbergii*, L.)

Marsh smartweed is extremely common in low grounds, especially in old lake beds and ponds. These ponds, when drained and planted to corn, grow up with this weed.

*Description.*—It is from one to three feet high, with long underground, brownish-black rhizomes; flowers, bright rose color, in long spikes, one to three inches long, seeds blackish.

This weed has frequently been received by us for identification, with the statement that it was difficult to remove. It is common from New England across the continent. In fields once thoroughly drained and cultivated, this smartweed is not a serious enemy to corn culture. The following is a sample of the numerous letters received in regard to the weed.

Mr. James F. Egan of Audubon, Iowa, sends specimen and writes as follows:

Find enclosed a bunch of roots which grow on my farm. They grow in patches and are from four to ten feet long. In plowing them it is like plowing hazel brush. I would like to know how to get rid of them. The tops die down in winter. They grow on high level land. Can you tell me what they are called. They grow in blue grass sod and also in the hard road. They do not bother corn a great deal but they smother oats and other small grain out.

*Extermination.*—Marsh smartweed or tan weed as it is some-



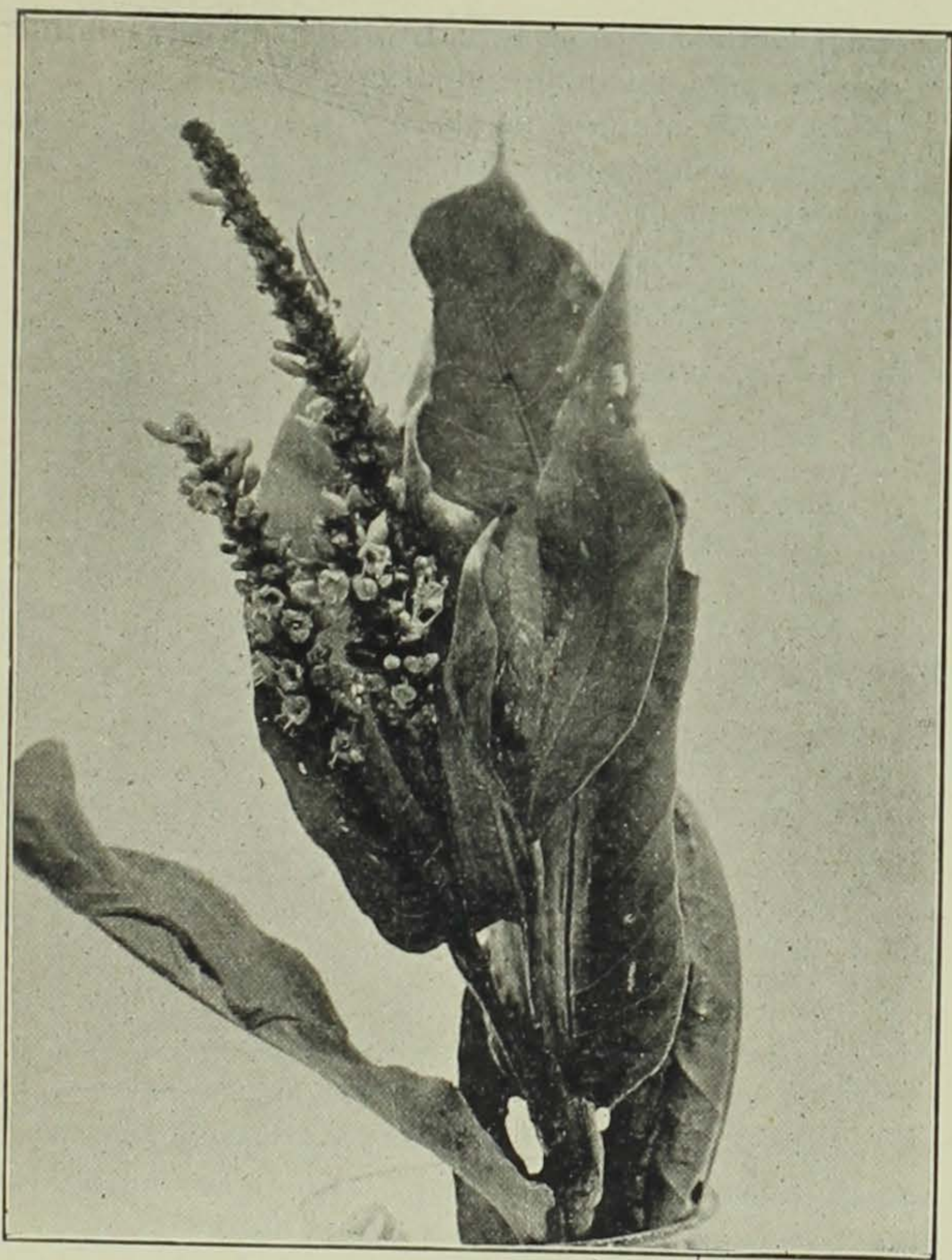


Figure 23. MARSH SMARTWEED (*Polygonum Muhlenbergii*), common in low ground.

times called is a persistent perennial and since the weed grows in wet places is particularly difficult to destroy. The best method of treating it is by thorough cultivation exposing all the rootstocks to the sun and then removing the young plants as rapidly as they make their appearance.

MARSH ELDER.—(*Iva xanthiifolia*, Nutt.)

The marsh elder is recognized as a weed of considerable importance in the corn fields of the western part of the state. It is also a weed of common occurrence in Nebraska, parts of



Kansas, and Colorado. In eastern Iowa it is chiefly confined to the railroad embankments and to dooryards.

*Description*.—An annual one to eight feet high, stem frequently pubescent when young, all the leaves opposite, rhombic, ovate, or the lowest heart-shaped, doubly serrate, or cut-toothed, obscurely lobed. The upper surface minutely scabrous, canes-



Figure 24. MARSH ELDER (*Iva xanthiifolia*). (Charlotte M. King).

cent beneath, especially when young. Petiole frequently ciliate at its upper end. Flowers borne in spike like clusters forming a compound panicle. Heads small, crowded; outer bracts of the involucre broadly ovate greenish; inner membranaceous; achenes glabrate. This plant is also known botanically as *Cyclachaena xanthiifolia*, Fr.

*Distribution*.—In Gray's Synoptical Flora its distribution is given as alluvial ground or along streams, Saskatchewan and Nebraska, to New Mexico, Utah and Idaho. First collected by Nuttall. In Watson & Coulter's edition of Gray's Manual its distribution is given as northwest Wisconsin to Minnesota, and Kansas westward. Marsh elder was originally native from northwest Wisconsin to New Mexico, as Fendler collected it in the latter place as early as 1845, but since the cultivation of the prairies it has become much more common. It was undoubtedly

Gray's Synoptical Flora 1: 246.



confined to alluvial soils, and from thence spread to neighboring areas, especially near barns and neglected buildings. In regard to the distribution, Conway McMillan says: "Minnesota valley throughout, especially south central and southwest districts, roadsides, banks and waste places." It must indeed have originally been quite local in many places in this region. It is only recently that this weed has attracted attention. The weed

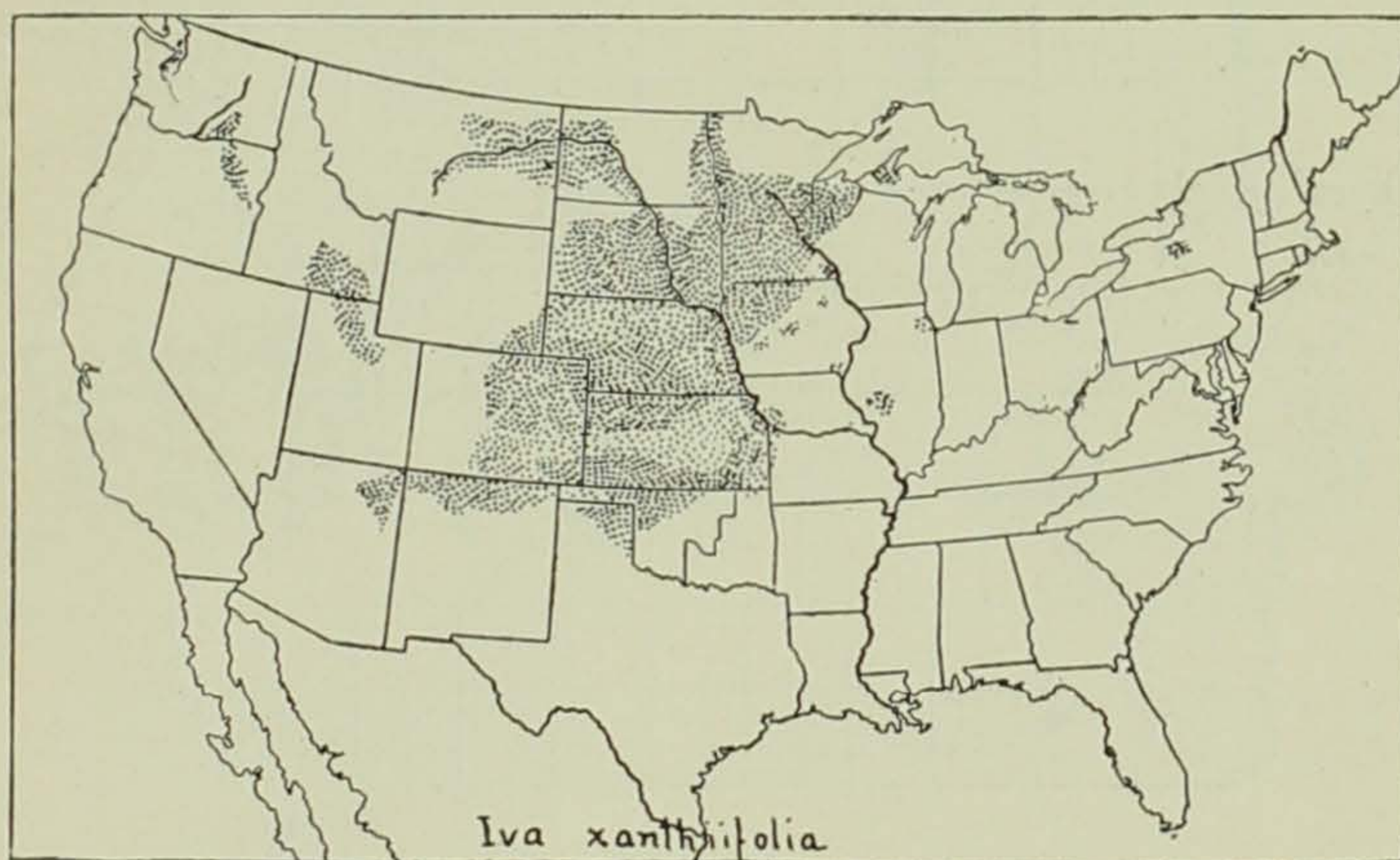


Figure 25. Distribution of Marsh Elder. (*Iva xanthiifolia*).

has been known in southwestern Minnesota, near LaCrescent, since 1881, where it occurred as an introduced plant along the embankments of the roads. Strange to say, this weed did not occur on the east side of the Mississippi river as late as 1897 at that point. This weed has not, however, spread very extensively in central Iowa. Its appearance at that point would indicate that the plant was not native but introduced.

In 1889 and 1890, this weed was growing in considerable quantity in a few places in the city of Boone, Iowa. The weed has made little progress east of Boone. In 1901 the weed was observed in Cerro Gordo, Kossuth and Emmet counties. J. C. Arthur writes that he observed it in Charles City, Floyd county, in 1871. This county joins Cerro Gordo on the east.

The writer observed it last fall here and there in Cerro Gordo county but not abundant. In the western part of the state this weed is extremely common as in Woodbury, Harrison, Monona and Fremont counties. It occupies not only the vacant lots but



is found in the streets and in corn fields. To the west of us in Nebraska it becomes increasingly abundant and in the irrigated fields of portions of Colorado it is frequently eight feet high. It is common in the Red River valley of the north and other parts of Minnesota and Dakota, and is a most aggressive weed as

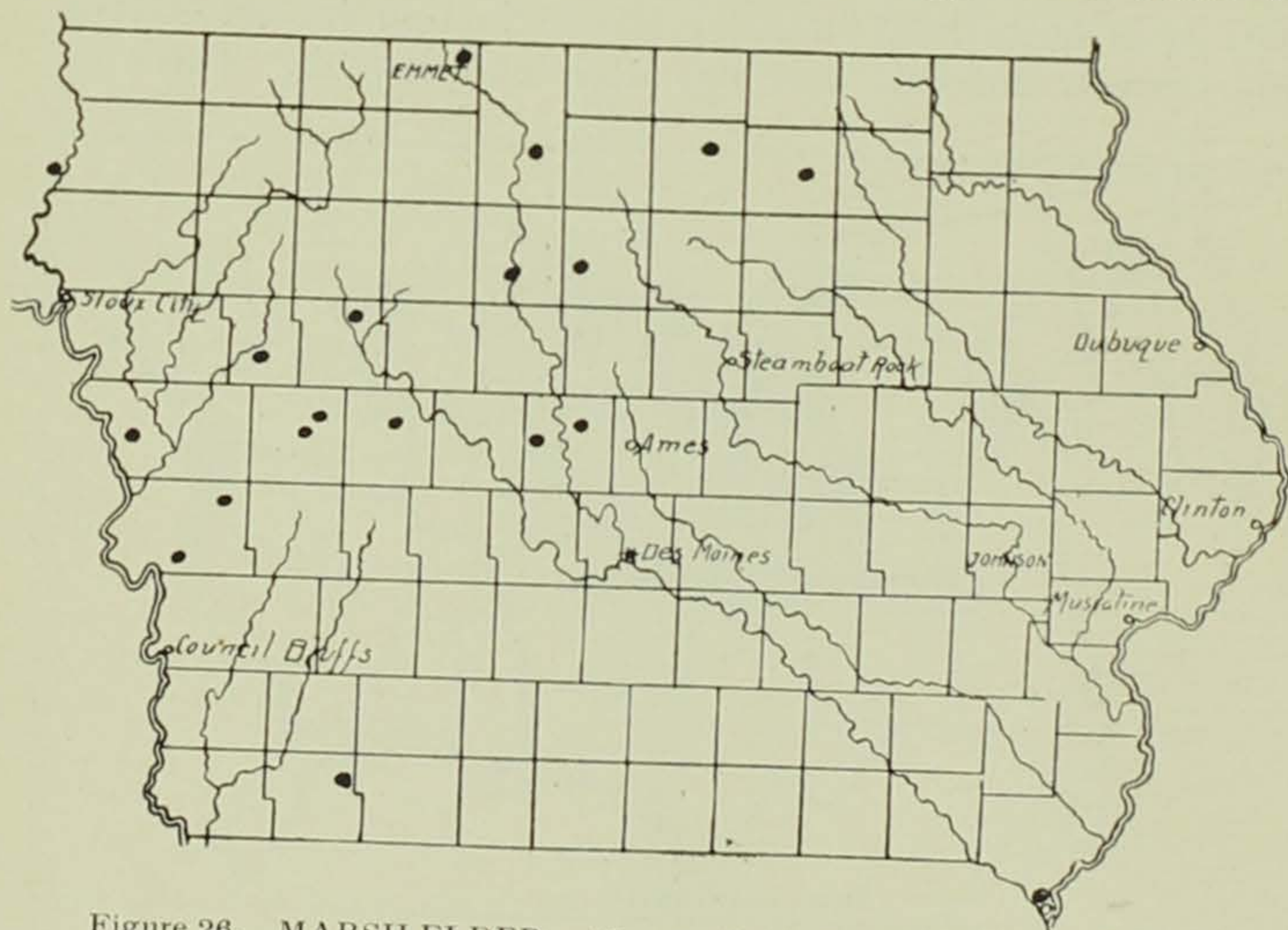


Figure 26. MARSH ELDER. (*Iva xanthiifolia*). (From specimens in the herbarium, Iowa State College).

Upham, Bolley, Crandall, and Bush indicate.

Its Iowa distribution is indicated by the accompanying map.

*Extirmination.*—Marsh elder is an annual and hence thorough cultivation for a single season will destroy it provided it is not allowed to form seeds.

### SUNFLOWERS.

Of the many annual weeds occurring in this state none are more troublesome in western Iowa, especially in the alluvial

Arthur (Contributions to Flora of Iowa. A catalogue of the phaenogamous plants. 18. Appendix to Flora of Iowa, 1876. 40). Charles City (Arthur, history of Floyd county) Boone (Pammel, report Com. On State Flora Proc. Iowa Acad. Sci. 1: 17) Boone, 1890 (Pammel). Keokuk, 1890 (Rofes). Boone, 1894 (Pammel). Woodbine, 1894 (Pammel). Vale, 1894 (Pammel). Mason City, 1894 (Pammel). Missouri Valley, 1894 (Pammel). Turin, 1894 (Pammel). Onawa, 1894 (Pammel). Carroll, 1894 (Pammel). Charles City, 1876 (Arthur). Humboldt (F. L. Harvey). Kossuth county (Pammel). Emmet county (Cratty and Pammel). See Pammel Proc. Iowa Acad. Sci. 2: 104.





Figure 27



Figure 28

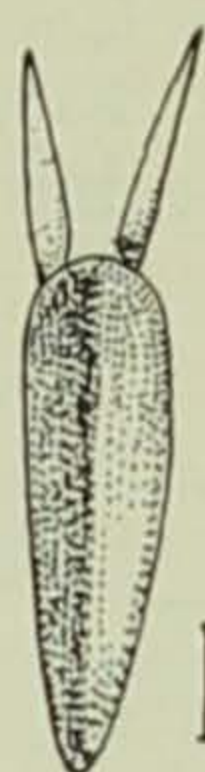


Figure 29

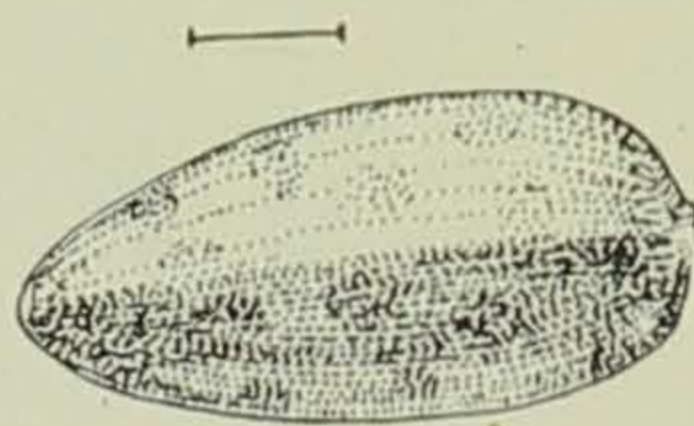


Figure 30

Figure 27. MAXIMILIAN'S SUNFLOWER. (*Helianthus Maximiliani*). (Britton & Brown). Figure 28. Meadow Sunflower, (*Helianthus grosseserratus*). Figure 29. Seed of Maximilian's Sunflower, (*Helianthus Maximiliani*). Figure 30. Seed of Large Annual Sunflower, (*Helianthus annuus*).

soil of the Missouri river than the common sunflower (*Helianthus annuus*, L.)

*Description*.—The sunflower is a tall, rough, annual, six to eight feet high, leaves three ribbed ovate or the lower cordate serrate; large heads, with yellow ray flowers, disk flowers brownish.

*Distribution*.—This species occurs in alluvial grounds from Saskatchewan to Texas, west to California and Mexico. This plant was native only in the western portion of the state along the loess bluffs and alluvial bottoms of the Missouri, but owing to cultivation and railroad traffic this weed has spread to many other sections of the state. It is likewise found in many other states of the Mississippi valley. It is more abundant on the plains of Nebraska, Kansas, to Texas, and because of its great abundance in Kansas that state has been called the "Sunflower State."

A related species, the *Helianthus petiolaris*, is smaller, from a foot to three feet high, lower branches with somewhat hispid stem leaves one to three inches long, from oblong to ovate lanceolate, entirely or sparingly denticulate. The lower leaves are abruptly contracted into a long slender petiole; the involucrel



bracts lanceolate or oblong lanceolate, with acute or mucronate tips. Flowers half an inch or more in diameter. This sunflower differs from the preceding in the character of the petiole

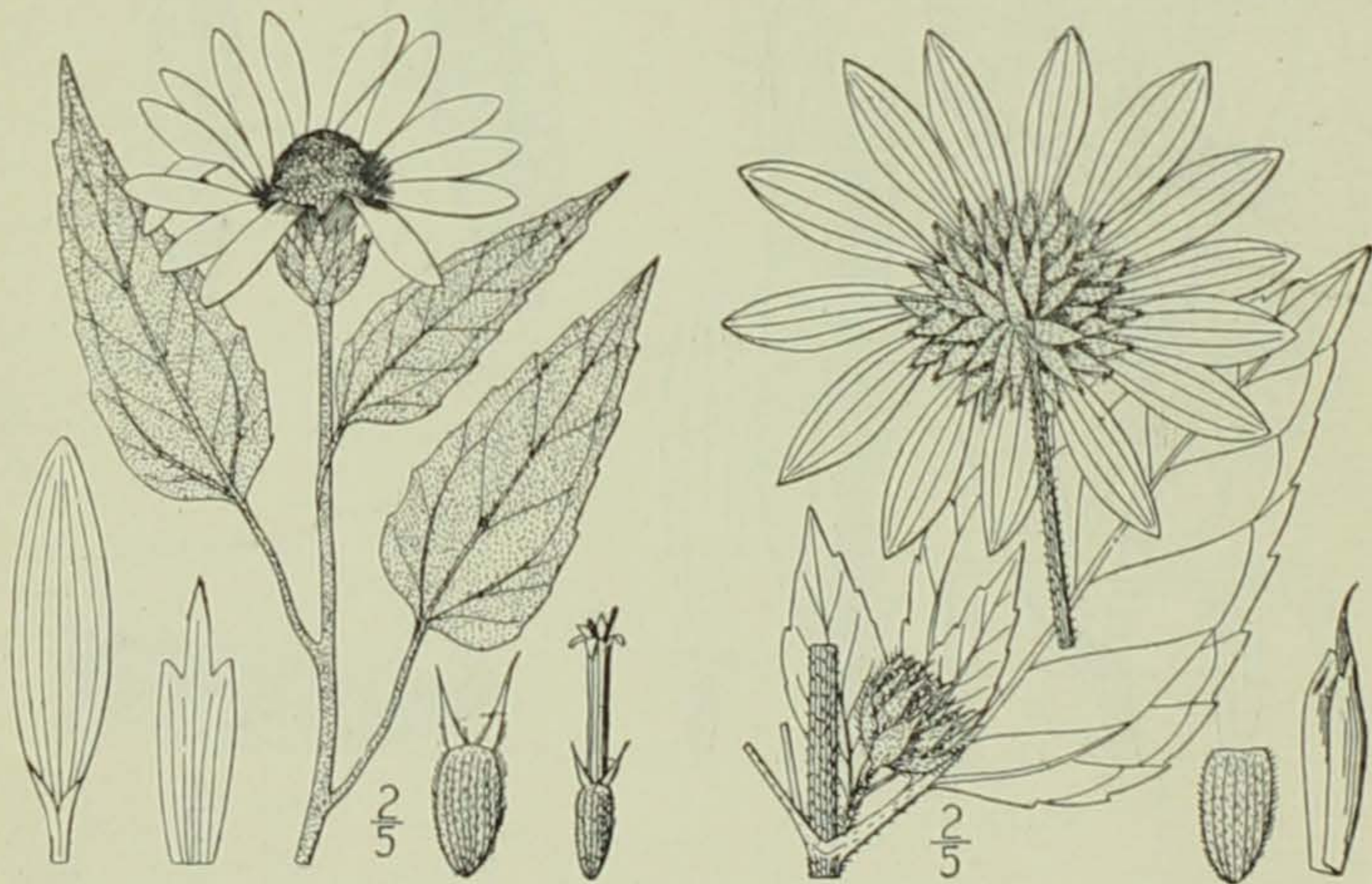


Figure 31. PRAIRIE SUNFLOWER (*Helianthus petiolaris*). (Britton & Brown).  
Figure 32. COMMON SUNFLOWER (*Helianthus annuus*). (Britton & Brown).

which is contracted, long and slender, the heads are also smaller.

*Distribution*.—It is found from Saskatchewan to Wisconsin, Iowa, Nebraska, to Texas and west to Arizona and Oregon. On the plains of Colorado, western Nebraska, and Kansas it is more common than the preceding species. It has been naturalized in eastern Iowa especially on Muscatine Island where it was undoubtedly introduced with stock cars. It occurs also along the railroad embankment for several miles.

The meadow or sawtoothed sunflower (*Helianthus grosseserratus*, Martens) is common throughout the state and while at times it is troublesome in corn fields and low grounds in corn fields it occurs usually in the swales where there is considerable moisture. Here it is sometimes difficult to remove until the soils are well drained. The meadow sunflower is frequent in Iowa in corn fields; it also occurs in meadows.

*Description*.—A tall, glabrous perennial six to ten feet high, bearing numerous short peduncled heads. The lower stem leaves eight to ten inches long and petiole from one to two inches long. Leaves opposite or alternate with a slender petiole, oblong, lance-



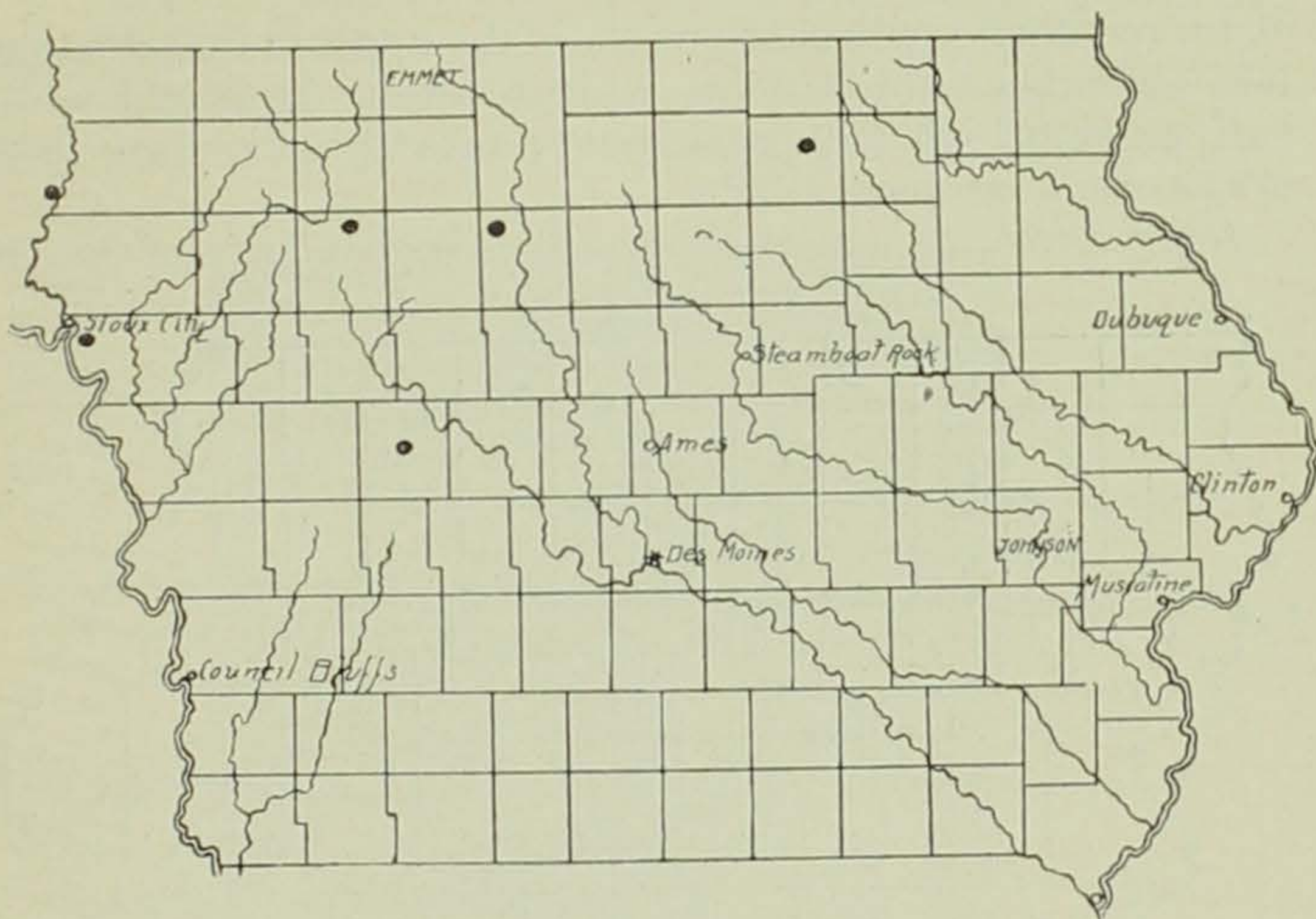
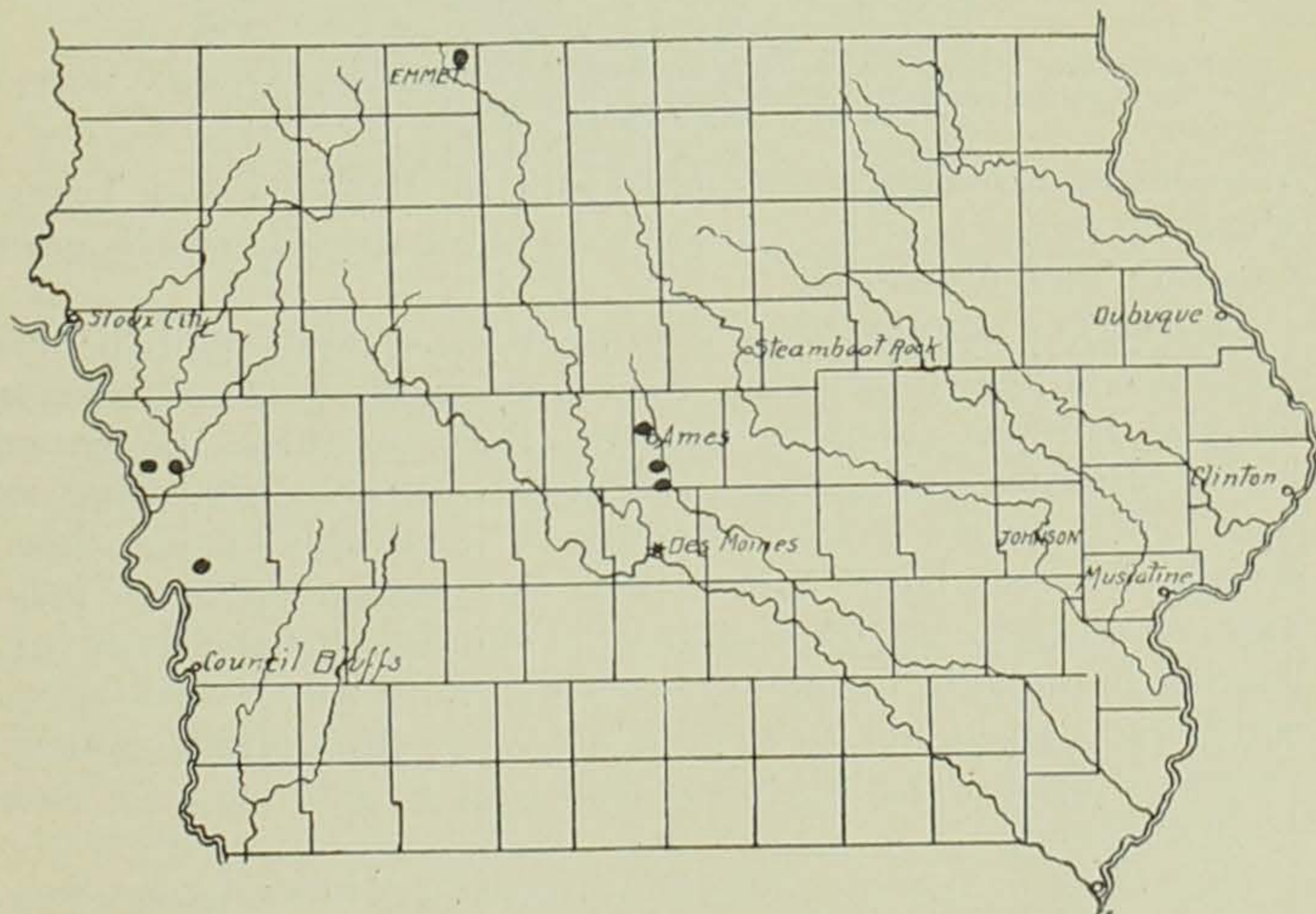


Figure 33. MAXIMILIAN'S SUNFLOWER (*Helianthus Maximiliani*).  
(From specimens in herbarium, Iowa State College.)



Figures 34. COMMON SUNFLOWER (*Helianthus annuus*). (From specimens in herbarium, Iowa State College).



olate, acuminate with sharp teeth, or the upper merely denticulate, somewhat scabrous above, whitish below. Heads (flowers) half an inch high with deep yellow rays about an inch long, bracts of the involucre slender.

*Distribution.*—Common west of the Alleghanies from Ohio to

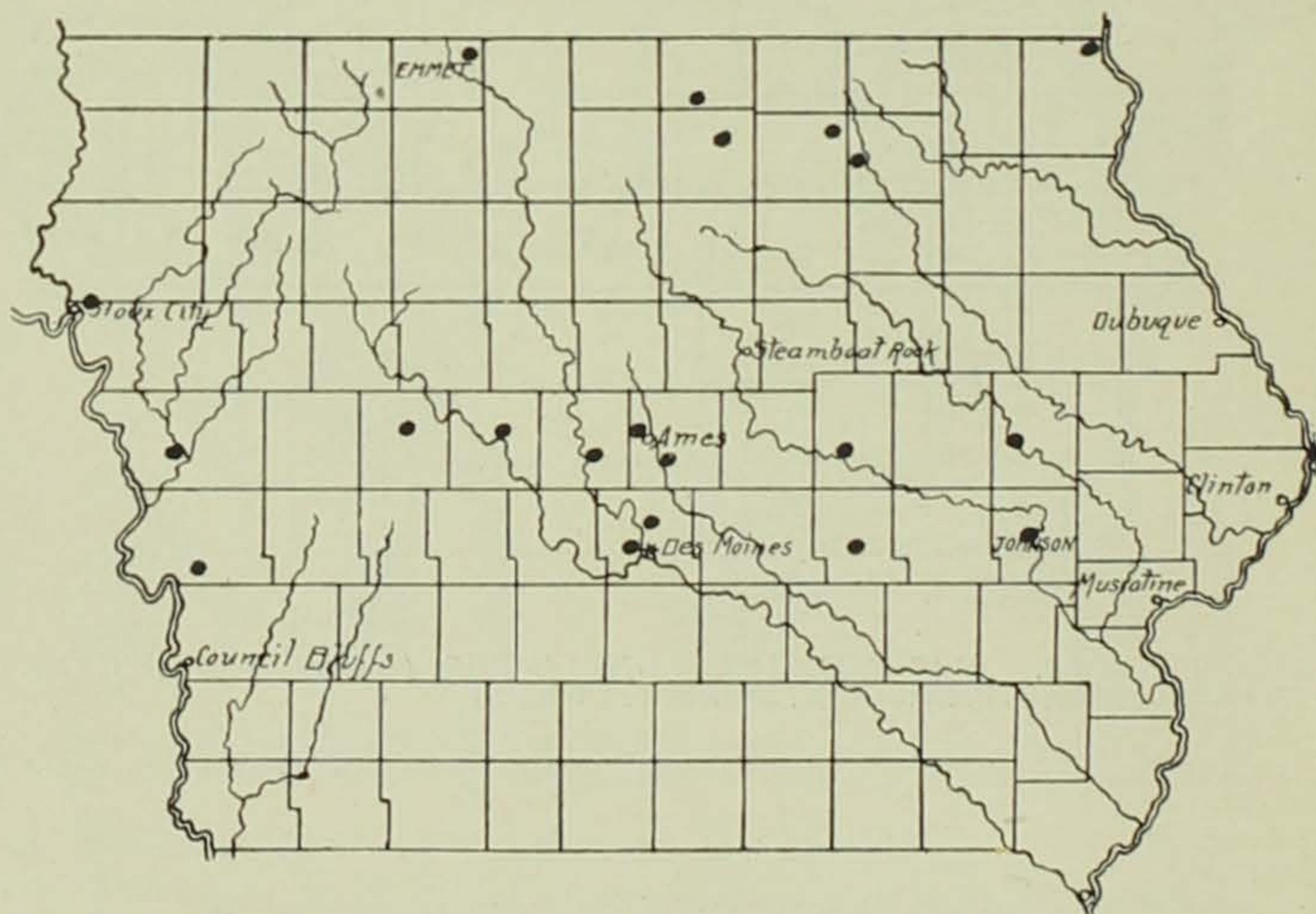


Figure 35. MEADOW SUNFLOWER, (*Helianthus grosse-serratus*). (From specimens in the herbarium, Iowa State College.

Wisconsin, Minnesota, Dakota, south to Missouri and Texas. Puzzling forms have been described as new species, occurring in Colorado and Wyoming.

*Helianthus Maximiliani*, Schrad, stem scabrous and hispid, from two to twelve feet high, the latter height being obtained in alluvial bottoms. Leaves usually alternate, thick, becoming rigid, scabrous above, hairy beneath, lanceolate, narrowing at both ends, nearly sessile, entirely or sparingly denticulate. Heads (flowers) large, half an inch to three-fourths of an inch high, short peduncle terminating the simple stem and later appearing in the axils of the lower leaves. Involucre consisting of rigid bracts about one inch and a half long. Ray flowers golden yellow, disk flowers brownish, flowering in late summer and early autumn.

*Distribution.*—From western Wisconsin, Minnesota and Saskatchewan through northern and western Iowa to Texas. This species is very common from Emmet to Carroll counties, south-



ward along the Missouri river. It is less abundant east of Emmet county, but nevertheless is found here and there.

*Extermination.*—The annual species should be treated as all other annuals are, preventing the formation of seed and thorough



Figure 36. SAWTOOTH SUNFLOWER, (*Helianthus grosse-serratus*).

cultivation. The perennial species need different treatment. Generally thorough cultivation will remove the weeds. It is certain that cultivating the young plants followed by three or four other similar treatments will remove the weed in a single season.

#### CANADA THISTLE.—(*Cnicus arvensis*, Hoffm.)

Many inquiries have come to the writer with reference to the Canada thistle. The weed has been described in former bulletins of the Experiment Station. The figures accompanying this paper illustrates the difference between the Canada thistle and the other allied species. The chief points of difference between



Canada thistle and other allied species are these: The head is smaller, the involucre or modified leaves surrounding the so-called flowers are not spiny but smooth. The leaves are lance shaped, sessile and deeply divided, the lobes and margins of the leaf have spiny teeth. The flowers are dioecious. This weed is

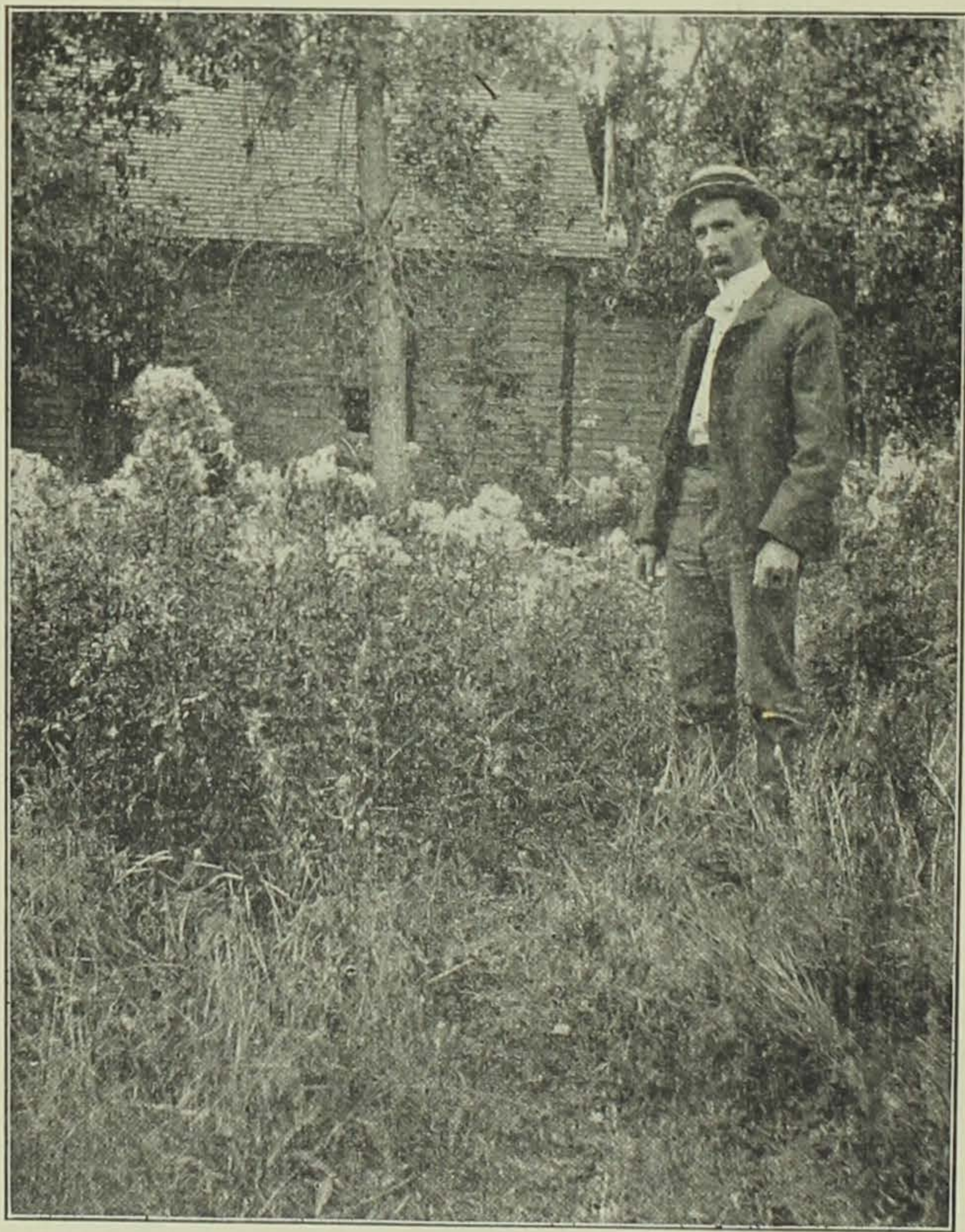


Figure 37. CANADA THISTLE, (*Cnicus arvensis*). The fluffy heads show the height of plant. (Photo. by L. H. Pammel).

particularly troublesome to the farmer because it produces the underground stems, the so-called roots, every one of which when severed from the plant develops into a thistle, if the conditions for growth are present.



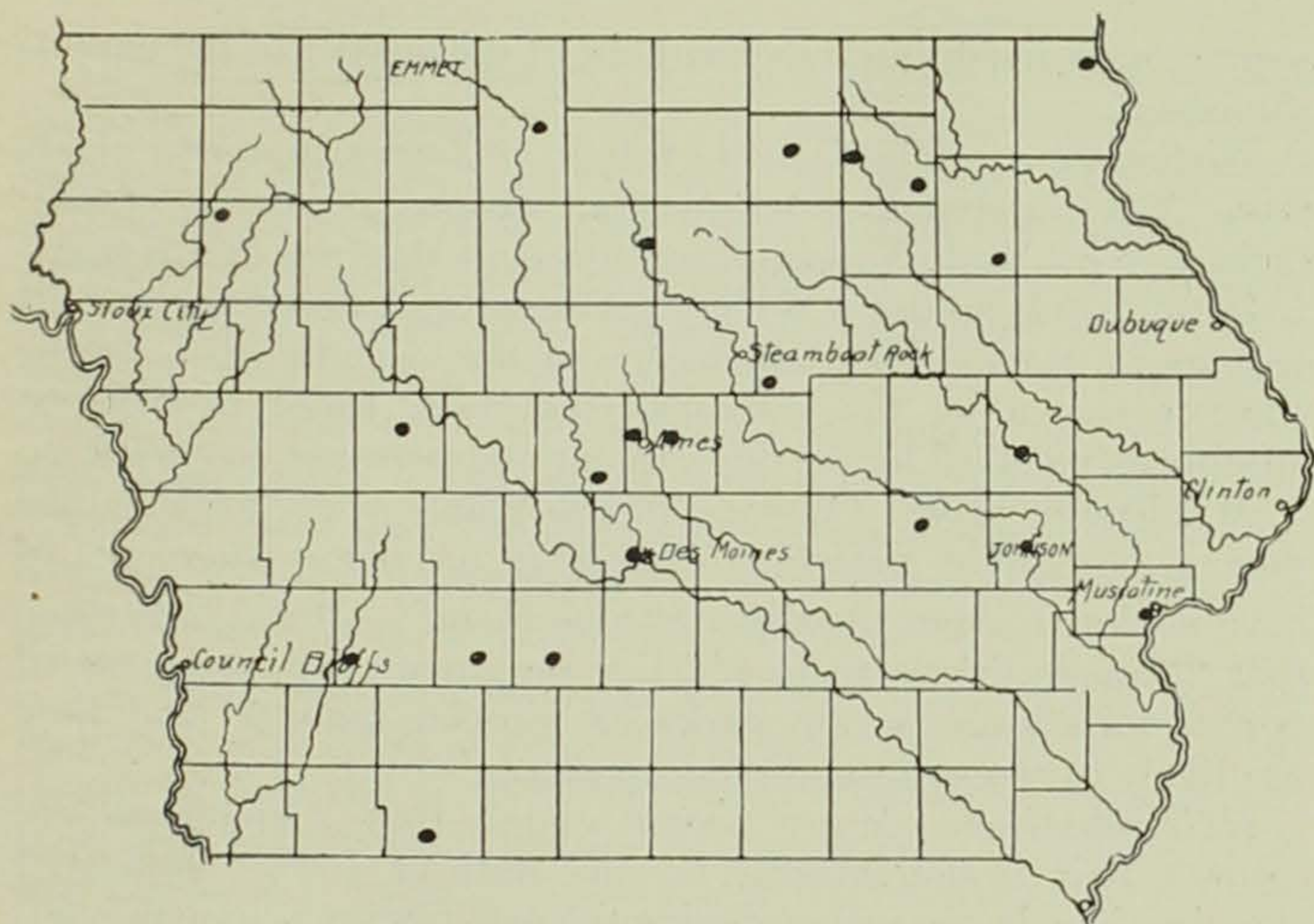


Figure 38. CANADA THISTLE, (*Unicus arvensis*). (From specimens in the herbarium, Iowa State College.)

*Description.*—Smooth perennial, spreading by creeping rootstocks, one to three feet high, corymbosely branched at the top; stem smooth; leaves lanceolate, sessile, and deeply pinnatifid, lobes and margins of leaf with spiny teeth; heads small, three-fourths to an inch high, bracts appressed, the outer with a broad base,

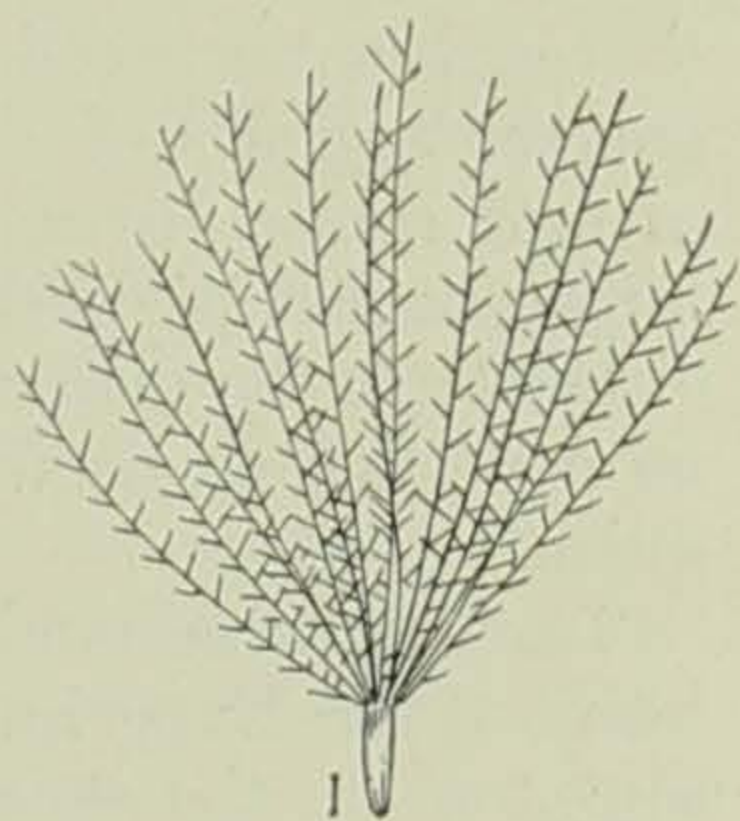
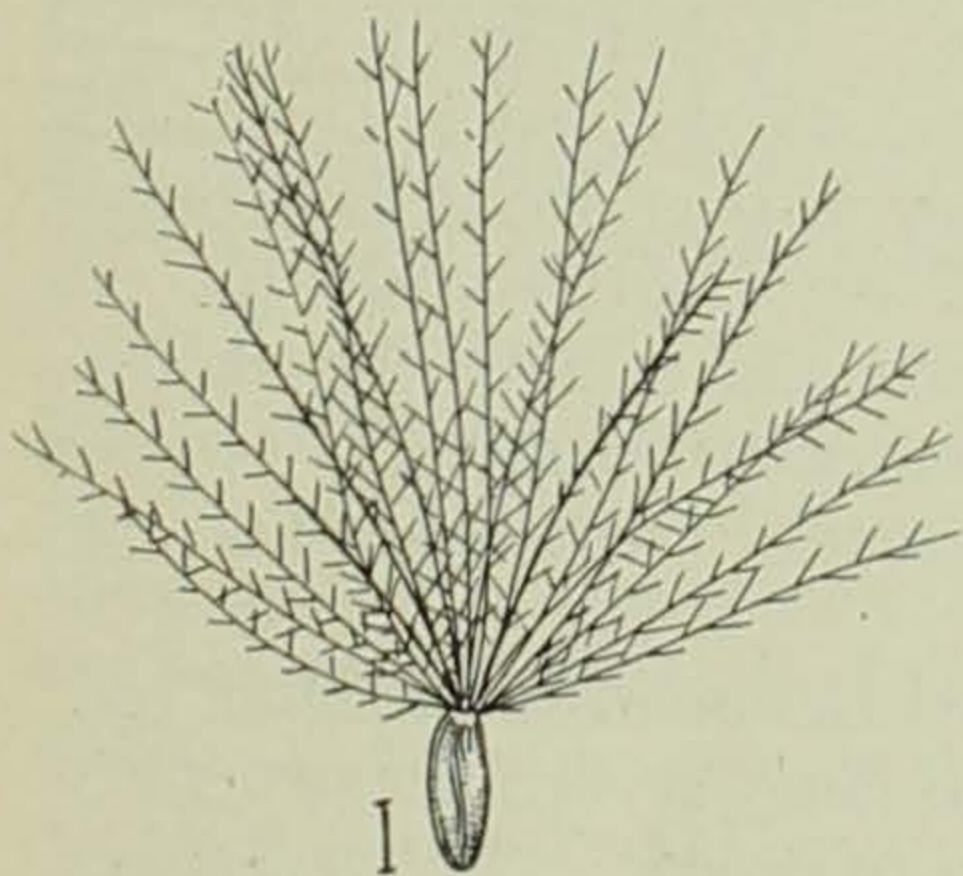


Figure 39. The Achenes of BULL THISTLE, (Charlotte M. King). Figure 40. Achene of CANADA THISTLE, (Charlotte M. King).

inner narrow, all with an acute, never spiny tip, somewhat arachnoid flowers purple, dioecious, in staminate plant flowers exerted with abortive pistils, in pistillate less so, scarcely exceeding the bracts, long stamens with abortive anthers, tube of the corolla six lines long, anther tops acute, filaments minutely pube-



scent, young achenium pubescent, all of the bristles of the pappus plumose.

*Distribution.*—The Canada thistle is found in waste places from Newfoundland, Nova Scotia, various provinces of Ontario, to New York, Virginia, southwest to Missouri and Kansas, Colorado to Montana. Widely scattered and found in isolated patches in Iowa. The distribution of the Canada thistle in the state is shown by the accompanying map, based in part on specimens received by the department and personal observations.

Mr. Dewey says: "Salting thistle plants every week or two during successive growing seasons in pastures where sheep have access to them usually destroys them." He says further that "Canada thistle roots will live for three years or longer in porous soils under straw stacks or piles of tanbark, and they are likely to creep out and send up shoots."

*Extermination.*—Many people claim that Canada thistle seeds. This is not general for the state of Iowa. Repeated examinations by the writer during the past few years in many sections of the state have shown that seed ordinarily are not produced, however, a few years ago the writer received specimens from northern Iowa in which well developed seeds were formed. Examinations of Canada thistles in LaCrosse, Chicago, St. Louis, Fort Collins and other points in the west failed to show seed. In Milwaukee, Wisconsin the plant seeded abundantly. The only method of treatment is to cut down and remove all the "roots" as far as it is possible to do so. If done frequently and thoroughly the weed can be removed. If the patch is a small one, cutting off the parts as soon as they appear above the ground several times during the season will certainly destroy it. In large patches plow the ground, harrow and remove the thistle, either burn the material or put into compost heaps. This should be done five or six times during the season as occasion may require.

The following method was described in one of the former bulletins of the Experiment Station: Recently several reports have appeared on the chemical destruction of weeds. The substance used for this purpose are known as herbicides, and on the college grounds the following preparations were used:

Carbolic acid . . . . . 1 part.

— U. S. Dept. of Agrl. Dewey Div. of Bot. Circ. 27:11.

Ann. Rept. Vt. Agrl. Exp. Sta. 12: 182.

Ann. Rep. Vt. Agrl. Exp. Sta. 12: 247.

— Pammel, Bull. Ia. Exp. Sta. 61: 145.



Water ..... 4 parts.

The solution was agitated to have a good mixture. It was found to be very essential to keep the acid and water thoroughly agitated in order to get an even distribution. At first an ordinary garden sprinkler was used. All of the plants were sprinkled. This was found to be expensive, nor did it kill more than the tops of the plant. Later, at the suggestion of Prof. Noble, a small mechanic's oil can was used. It was found that where the stems were touched with the solution the rootstocks were killed from a few to ten inches below the ground, but below this point they sprouted again in some cases. Generally, however, they did not sprout again. Where there are many plants this method is very laborious and costly.

We, therefore, tried the spud method. The patch of thistles was in a blue grass lawn. The thistles continued to appear, largely because the ground was thickly covered with plants and they were not always detected. Early in June the whole patch was plowed and as soon as the young thistles appeared the carbolic acid solution was applied with the mechanic's oil can. The dry weather helped to remove the thistles. Mr. Elder says in regard to the thistles in the yard adjoining that of Prof. Noble, "The thistles in Mr. Gray's yard were allowed to become twelve inches high, when they were cut with a scythe. The number of shoots which appeared within two weeks was marvelous. The solution was applied with the same effect as above. Three or possibly four applications usually cleared a given patch. An examination of the ground in September showed only a few thistles remaining, and these had been hidden by the grass in such a manner as to escape detection."

Prof. Noble who has kept close watch of the thistles informs me that he has found but few this season and these were overlooked in the grass adjoining the plot. On June 25th the writer went over the patch which is now sown with oats and was able to see but a single Canada thistle; so we may conclude that this experiment was a success, and that anyone who desires to have the Canada thistle removed can do so in this way.

As to expense we used two gallons of crude carbolic acid, and the labor amounted to thirty hours at fifteen cents per hour, and the plowing to seventy-five cents.

We may conclude from this experiment that Canada thistles can be destroyed by methodic removal of the plants and crude carbolic acid.



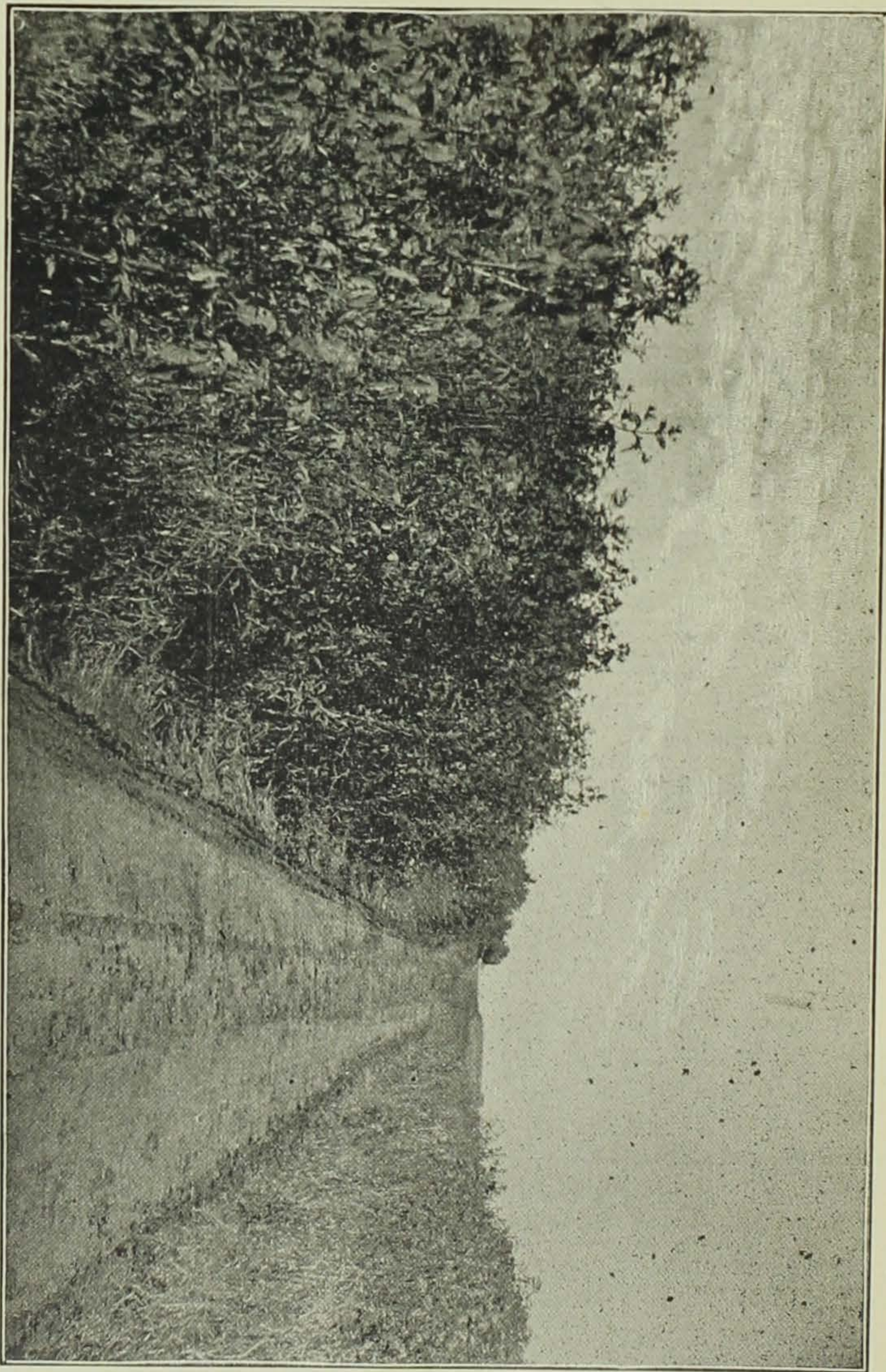


Figure 41. GREATER RAGWEED, (*Ambrosia trifida*), along a country road. (Photo. by W. Newell).



## THE RAGWEEDS.

The ragweeds are mostly annuals, come up in early spring, make a rapid growth, flower in August and September, and produce an enormous quantity of seed. They are readily destroyed, but the seed undoubtedly retains its vitality for some



Figure 42. GREATER RAGWEED, (*Ambrosia trifida*). (Britton & Brown).

time. I remember well on my father's farm in Wisconsin that, although the rich soil had been in meadow for some time ragweed would appear in some places when sown with wheat. The seeds were to some extent carried by the drifting snow in winter, others perhaps retaining their vitality. In driving through the country or riding in cars nothing is more unsightly than this ragweed, which is allowed to grow everywhere. Nothing is done to check its growth. In some cases enough is cut off to allow vehicles to pass with ease, but along the fences this mighty weed grows seven or eight feet high.

*Description.*—*Ambrosia trifida*, L. is a stout scabrous, hispid or nearly glabrous annual, three to twelve feet high. Leaves all opposite and petioled, three nerved, deeply three to five lobed, the lobes are ovate lanceolate and serrate, the upper leaf sometimes ovate and undivided; flowers monoecious, staminate borne in spikes surrounded by the larger bract-like leaves. The in-



volucre is turbinate to obovoid, five to seven ribbed, beaked, each rib bearing a tubercle near the summit; the involucre enclosing a single oily seed.

*Distribution.*—The greater ragweed is distributed from Quebec to Florida throughout the Atlantic region to Texas, common throughout the Mississippi valley west to Colorado and Northwest territory.

*Description.*—*Ambrosia artemisiaefolia*, L. is a purulent or hirsute annual, branched, one to three feet high; leaves thin,



Figure 43

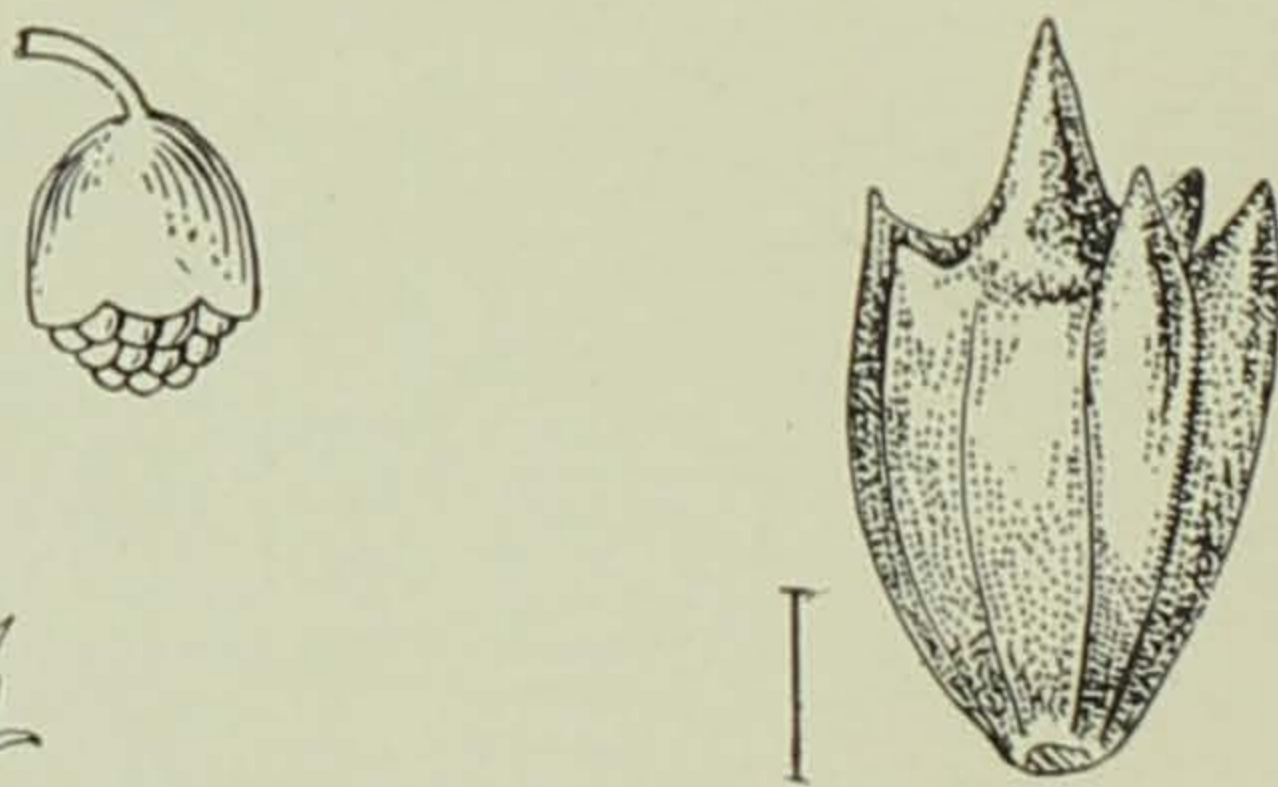


Figure 44



Figure 45

Figure 43. SMALLER RAGWEED, (*Ambrosia artemisiaefolia*). (Britton & Brown.) Figure 44. GREATER RAGWEED, (*Ambrosia trifida*). Figure 45. SMALL RAGWEED, (*Ambrosia artemisiaefolia*).

once to twice pinnatifid; the upper leaves are alternate, the lower, usually opposite, pale or canescent beneath. Flowers monocious, the staminate above and the pistillate in the lower axils of the leaves. The fertile heads are obovoid or globose. Short beaked. Four to six spined.

*Distribution.*—A troublesome weed in all parts of the state. Introduced from Europe. Its distribution in North America is from Nova Scotia to Florida throughout the Atlantic states and Mississippi valley. In the Rocky mountain region and west to British Columbia. Also occurs in Mexico and the West Indies and South America.





Figure 48. SMALLER RAGWEED, (*Ambrosia artemisiaefolia*). Division of Botany, U. S. Dept. of Agriculture.



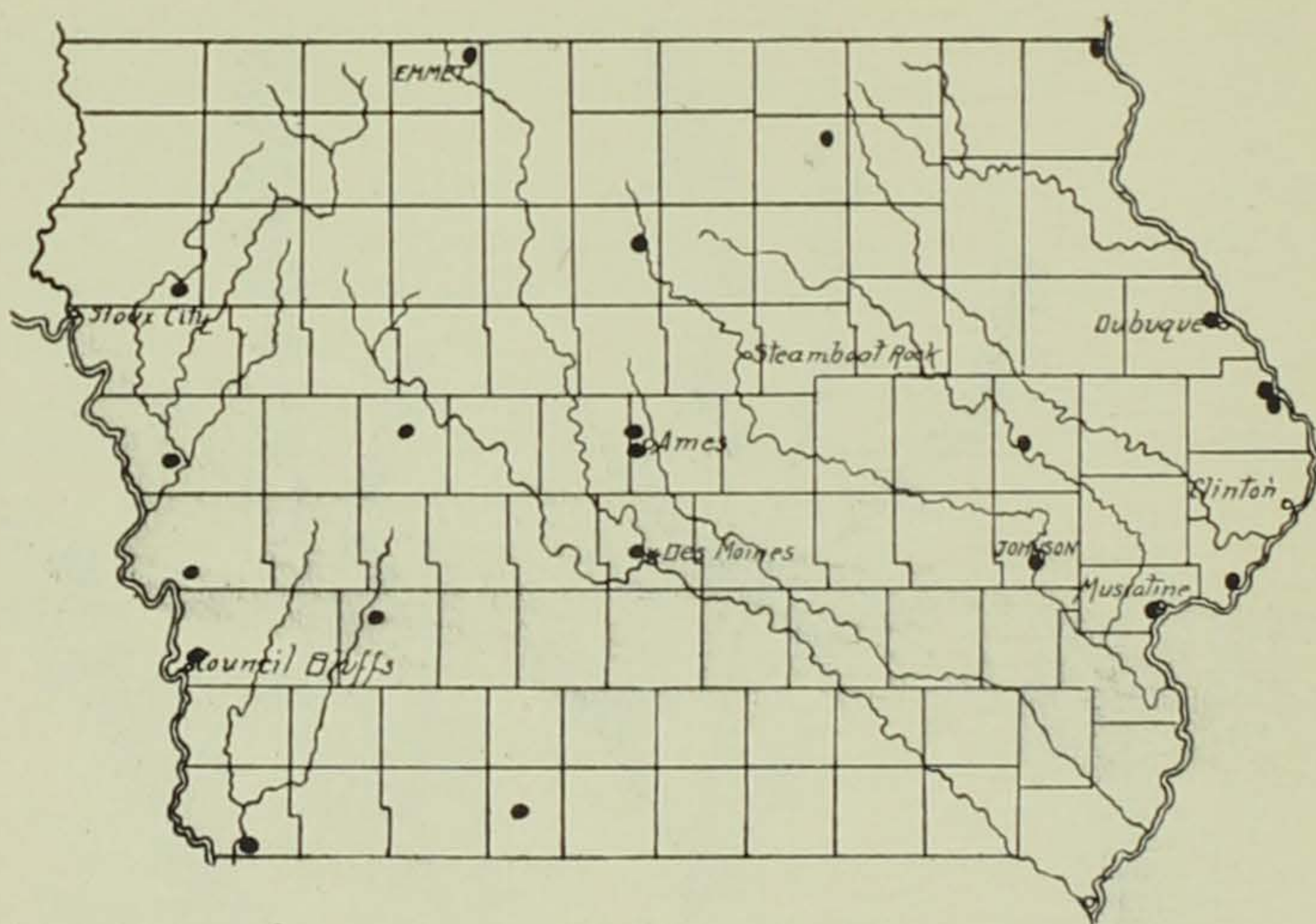


Figure 47. SMALLER RAGWEED, (*Ambrosia artemisiifolia*). (From specimens in the herbarium, Iowa State College).

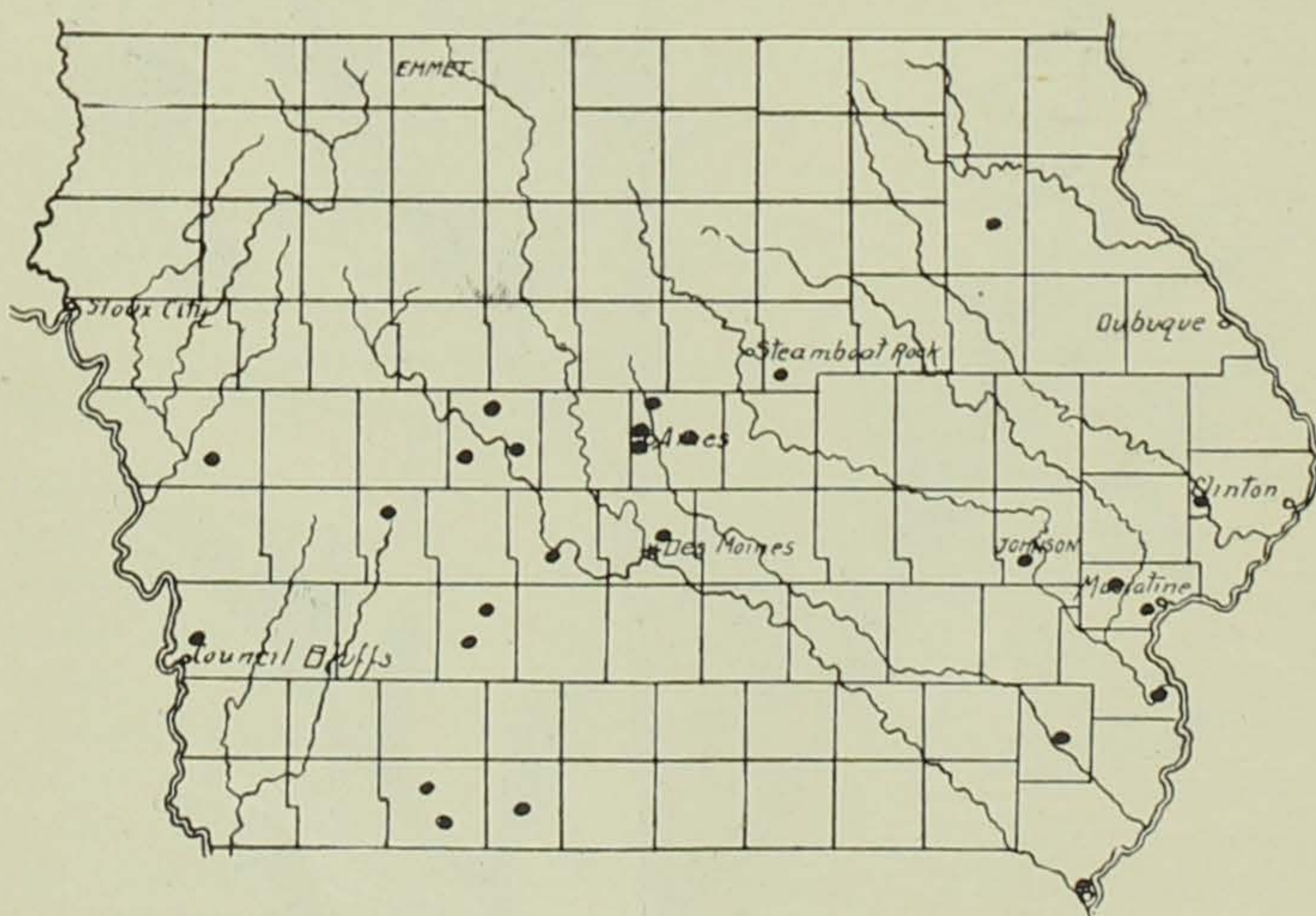


Figure 48. HORSE NETTLE. (*Solanum Carolinense*). (From specimens in the herbarium, Iowa State College).



*Extermination.*—One of our correspondents sends the following communication: "Please tell me the name of the enclosed weed seed and how they can be cleaned out of wheat, either during threshing or after. Grain buyers here say they can not be gotter out and they cut the price ten cents a bushel if there are a few of them in the grain."

The ragweeds are readily exterminated since they are annuals. The large seedlings making their appearance in the spring can be killed by a single cultivation. The somewhat older plants can also be killed by a single cultivation. The important point in connection with ragweed is to prevent the formation of seed. This can be done by keeping the plants down. Rotation of crops should also be practiced.

**HORSE NETTLE.**—(*Solanum Carolinense*, L).

During the last few years many complaints have been received by the station from various parts of the state in regard to the horse nettle. It has been reported nearly as far north as the Minnesota line.

*Description.*—Horse nettle is a deep-rooting perennial, propagating freely by its underground rootstocks, these running roots are often three feet long; stem from one to two feet high, somewhat straggling, half shrubby at the base; stem hairy or merely roughish with minute hairs which are star-shaped, also armed



Figure 49. The distribution of Horse Nettle and Tribulus.



with stout subulate yellowish prickles which are usually numerous; leaves oblong or sometimes ovate, obtusely sinuate, toothed or lobed or deeply cut, two or four inches long. The flowers are borne in what are called racemes, which later become one-sided; the outer part of the flower, the calyx, consist of slender lobes, the corolla is light blue or white, an inch or less in diameter. The flowers are followed by the yellow globose berries, half to three-quarters of an inch in diameter. The small seeds are yellowish, a little less than one-twelfth of an inch long, minutely roughened. The flowers resemble those of the common potato, and are blue or white, an inch or less in diameter. The yellow berries also resemble those of the potato. The spiny character of the leaves and the further resemblance of the flower to the potato should render it easy of detection.

*Distribution.*—Its distribution in North America is from Connecticut through New York, Pennsylvania, and New Jersey, West Virginia, along the Atlantic seacoast to Florida, west along the Gulf coast to Texas, through Kansas, Nebraska, Iowa, Illinois, and Michigan.

The plant though native to North America has been introduced into this state. Its date of introduction on the college farm began about 1889. Previously it had been reported only from southwestern and southern Iowa and from western Iowa as far north as Council Bluffs. In another connection the writer traced its distribution in the United States. It was probably originally a weed native to the Gulf states and early in the century was transported to Pennsylvania and West Virginia. This weed is quite as troublesome or difficult to exterminate as the morning glory or Canada thistle.

*Extermination.*—There are two methods of propagation. One by seeds, the other by the perennial "roots;" both of these methods help to extend its range over the country. It is as difficult to eradicate as the Canada thistle.

On this, Mr. Dewey says:

Ordinarily, cultivation has comparatively no effect on it, often tending to multiply and improve its growth, rather than to subdue it. It is more or less troublesome in all crops and in all soils, but is worse in sandy or loose, friable soils, which are easily penetrated by the long rootstocks.

It is an exceedingly tenacious weed, and so tenacious to life that it is almost impossible to remove it when fully established. A correspondent, Mr. Hollister, of Port Byron, Ill., states: "It is as bad as Canada thistle, and this has been realized by many farmers."



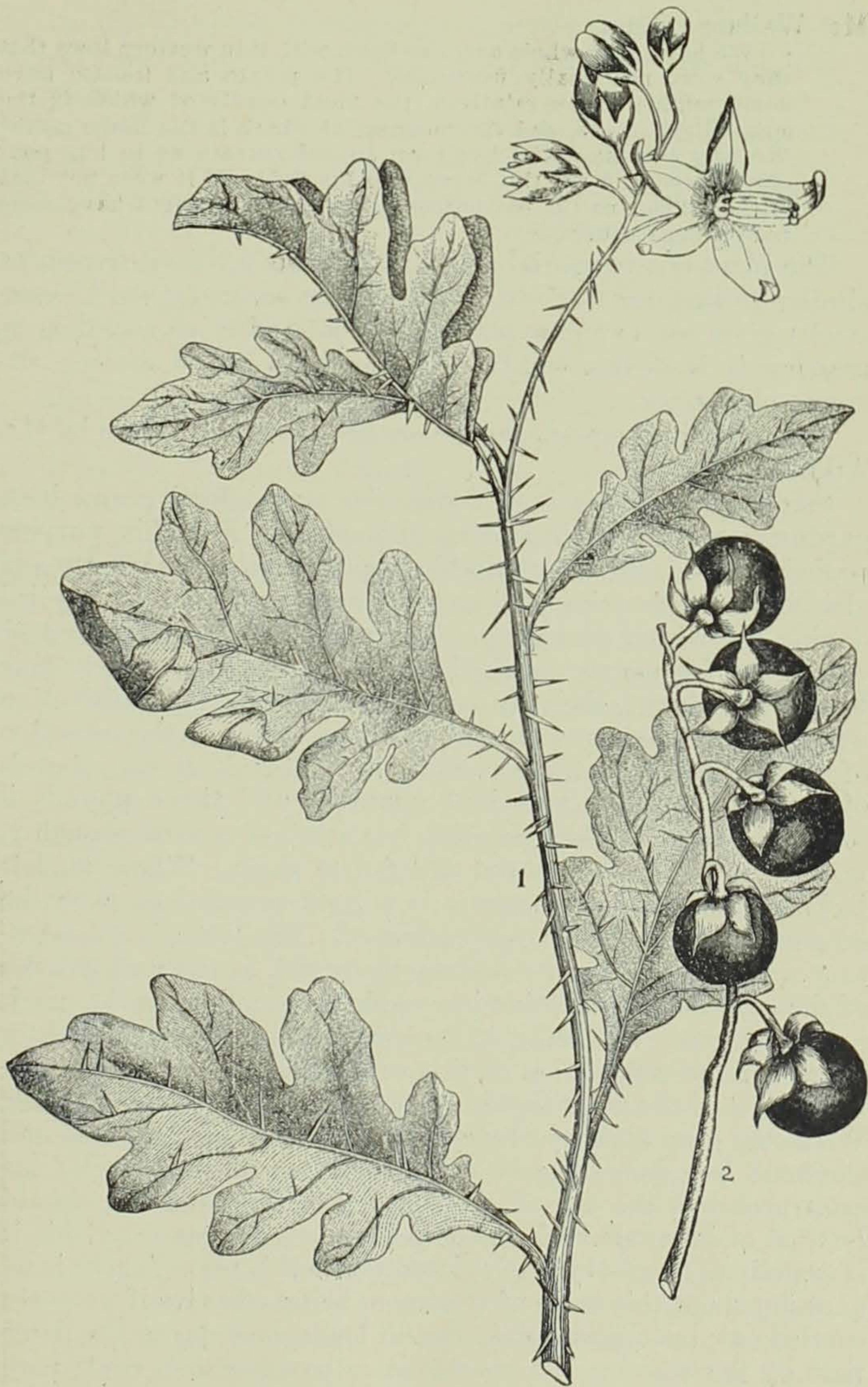


Figure 50. HORSE NETTLE, (*Solanum carolinense*), a perennial weed. Division of Bot., U. S. Dept. of Agriculture.



Mr. Wallace states:

We have seen whole acres so thick with it in western Iowa that they were practically worthless. The potato and tomato have some mighty mean relatives, the most deadly of which is the spiny night shade, and the meanest of which is the horse nettle. We pity the man who has been so unfortunate as to buy poor clover seed and get this weed into his field. If it were not that neither sheep, cattle, nor horses would eat it, it might have some redeeming feature.

The plant is a perennial and that suggests a line of treatment similar to that for Canada thistle. Every severed "root" (root-stock) gives rise to a new plant. The only effective way then of treating it is to thoroughly cultivate the soil and destroy the young plants.

The following very suggestive methods have been given by Mr. Atkinson.

*Smothering.*—This is probably the most effective and least expensive method of removing this plant. For this purpose probably rape is the most suitable crop. If the soil is not already rich a liberal dressing of barnyard manure should be applied during the winter or spring. The soil should be harrowed or cultivated frequently until the time of seeding, which may be any time during the months of May or June. This cultivation will prevent weed growth, and will also assist in the retention of moisture. If the rape is sown in drills, about two pounds of seed per acre is a sufficient quantity, and three pounds if sown broadcast. When the crop has attained a rank growth it may be pastured or removed and fed to stock. Where land is lacking in vegetable matter it is a good practice to plow the crop under when it is properly matured. The latter is not necessary when the object is to destroy the nettle, as the rank growth of the crop is very effective in completely smothering the weed.

*Hoed Crops.*—Planting to corn or roots is a method much in vogue for the destruction of this vile intruder. As in the previous method the plant should be kept down before seeding time. When the crop appears above ground the use of the horse and the hand hoe should not be sparing. When the welfare of the crop prohibits the use of the horse hoe, the hand hoe should be used at intervals until the crop is removed, even after this it is sometimes necessary to give attention to this pest. There is no question about this mode of treatment being effective if properly carried out, but failure often lies in negligence during the latter part of the season. Of course, it is possible that seeds may be lying dormant in the soil and make their appearance the next season, but it is taken for granted that all measures to



eradicate the plant by preventing the production of seed have been used, and still there is failure, in which case the soil will not contain any seed.

*Other Methods.*—The removal of the nettle when in a well advanced stage, but before the production of seed (as when cut with clover or early cereals) is often resorted to, the idea being to kill the plant by shock. It must be confessed, however, that this method is not sufficiently effective to be endorsed as a means of complete eradication, but is simply an effective means of preventing the production of seed.

**BUFFALO BUR.**—(*Solanum rostratum*, Dunal.)

Last season numerous requests were received to identify certain weeds. The most abundant of these was spiny nightshade or buffalo bur (*Solanum rostratum*, Dunal.) We would suggest that the common name, buffalo bur, be used. This weed seems to have attracted unusual attention last year because of the prickly nature of its fruit, stems and leaves, so much so that farmers usually thought it was the Russian thistle. It has, however, no resemblance to this weed, the two being very different. A full description and account of the Russian thistle is given in Bulletin 26 of the Experiment Station. Buffalo bur is by no means a new weed for the state. It probably occurred in the western part of Iowa before the country was settled. Cultivation of the soil, has, however, brought it into prominence.

*Description.*—Herbaceous, woody when old, somewhat hoary or yellowish, eight inches to two feet high, covered with copious stellate pubescence. The branches and main stems when it begins to branch are covered with yellow sharp prickles. Leaves somewhat melon like, one to three times pinnatifid, lobes roundish or obtuse and repand, covered with soft pubescence, hairs stellate. Flowers yellow, corolla gamopetalous about an inch in diameter, nearly regular, the sharp lobes of the corolla broadly ovate. Stamens, five, declined, anthers tapering upward, linear lanceolate, dissimilar; the lowest much larger and longer with an incurved beak, hence the technical name *rostratum*. Style much declined. Fruit a berry but enclosed by the close fitting and prickly calyx, which has suggested the common name buffalo bur. Pedicels in fruit erect. Seeds thick, irregular, round or somewhat longer than broad, wrinkled showing numerous small pits; seeds surrounded by a gelatinous substance.

*Relationship of the Plant.*—This plant belongs to the order



*Solanaceae*, or night-shade family. Well known representatives of the family are the potato and tomato. It contains several troublesome weeds like the horse nettle (*Solanum Carolinense*) and the rapidly spreading northwestern weed *Solanum triflorum*. Several members of the family are medicinal plants like Hen-



Figure 51. BUFFALO BUR, (*Solanum rostratum*). (Charlotte M. King).

bane (*Hyoscyamus niger*) and belladonna (*Atropa Belladonna*.)

*Distribution*.—The buffalo bur was undoubtedly a native to the region of the plains occurring in barren places where grass is scant, and in former times was most abundant around "buffalo wallows." Prof. Henry says: "When I was in Colorado from 1873-1876 I found *Solanum rostratum* growing almost everywhere on the plains in the vicinity of Denver." Its range is from New Mexico to Wyoming and across the plains. The



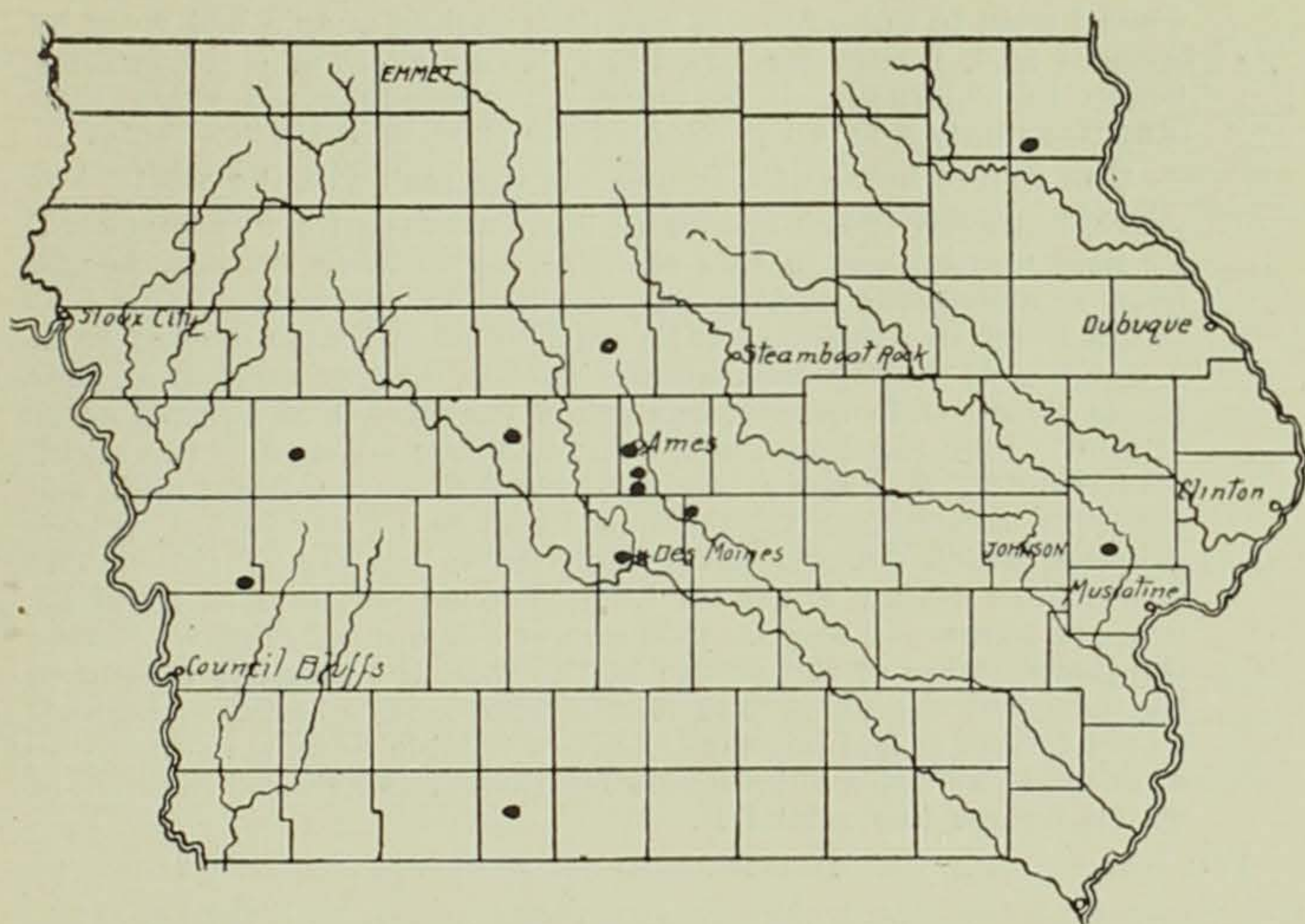


Figure 52. BUFFALO BUR, (*Solanum rostratum*). (From specimens in the herbarium, Iowa State College).

general traffic from the west to east has caused the weed to be distributed in various eastern and middle states, Iowa, Minnesota, Wisconsin, Missouri, Illinois, Indiana, Ohio, New York, Massachusetts, Tennessee. The weed has been found in Germany and has occasioned some alarm. The writer found this weed at Watertown, Wisconsin, in 1887 and since then reports of its occurrence in eastern states have become more frequent. Dr. Byron D. Halsted reported this weed in central Iowa in 1887. The writer reported this weed from Chariton, Iowa, and Elmira, Illinois, in 1890 and 1892.

It is undoubtedly one of the most troublesome weeds with which the farmer comes in contact in parts of the west and southwest as is well known to all who have visited Texas, Colorado and Kansas.

The writer in commenting on this weed says:

In Texas it is a most striking weed along the roadsides and in fields, it is so aggressive as to kill out all other plants especially in the streets of villages and cities. Cattle carefully avoid it. Even in pastures and meadows where much tramping is done this weed is a very aggressive one. Prof. C. S. Crandall writes me as follows, "My first acquaintance with the plant dates from 1890,

Pammel—13th Biennial Rept- Iowa Agrl. Coll.

" Iowa Homestead. Nov. 21, 1890.

" Iowa State Register. March 16, 1892.

" American Agriculturist. 50:387.



when I went to Colorado. It was then spoken of as a bad weed by farmers and, I presume has been known as such since farming began in Colorado. It is more troublesome some years than others, as only a small portion of the seed matures."

The native home of this plant is the plains of the west. For years, however, it has gradually been working its way eastward. Its first appearance in this state seems to have been in Adams county, specimens having been collected on waste ground at Camp Point in August of 1878. It has since been reported from a number of widely separated localities, and at one place near Eagle Point, Ogle county, has taken possession of several acres of land. Like the horse nettle the sandbur belongs to the nightshade family. It forms a branched plant one or two feet high, and presents a striking appearance because of the stout yellow prickles which densely cover the stems, leaves and fruit. The flowers are yellow about an inch in diameter, and at maturity produce numerous seeds. It is one of our annual plants. Before the introduction of the potato in the west the sandbur is said to have formed the chief food of the potato bugs there. Although as yet the plant has not caused much trouble here, it is one to be considered as quite undesirable because of the liberal manner in which nature has armed it.

We have given the distribution of this weed quite fully in the Report of the Iowa Academy of Sciences, Vol. II, p. 114, which the reader may consult.

Of the numerous letters we have received in regard to the pestiferous character of this weed, we insert the following from Mr. Charles Ashton of Guthrie Center. "The weed grew on the southwest side of the track on the sloping bank and in a pile of rotted manure that Mr. Mitchell saw thrown out of a stock car last March, so that it had favorable conditions to its large spread. The thing grew not more than four rods from the street leading west from this town and just beyond the western extremity of the town. On Friday morning Mr. E. G. Stowell and myself separated the branches from the stock and carefully counted the burs formed and growing thereon; they reached the aggregate of 1895. We opened one bur and counted the seeds it contained, and found them to number sixty-six. Averaging the number even at thirty should the burs then formed on the plant mature the seeds produced would aggregate 59,550, certainly a production showing vast multiplying powers. The leaves had strong resemblance to the leaf of a potato. The blossoms were about the size of a potato blossom, perhaps slightly larger. The inside of the flower is very much the same to the eye as the interior of the bloom of the potato." Mr. Carver found one specimen in a creek bottom here at Ames fully as large as Mr. Ashtons plant.

On the abundance of this weed I may state that I have seen



weeds numerous in the streets of Creston and other parts of Iowa, it is especially common in the southwestern part of the state. I am further convinced that unless the farmers will speedily destroy the plants we may expect fully as much trouble from this weed as the Russian thistle. It delights to grow in our cultivated soils. This weed seems to be scattered in two ways; one by means of stock trains, and the other with garden seeds. The occurrence of the weed in gardens so frequently in Iowa, leads me to believe that this weed has been disseminated in our state more especially by the latter method. I wish to emphasize in this connection the importance of using care in the purchase of seed.

*Extermination.*—Inasmuch as this weed is an annual it can easily be exterminated by cutting off the young plants below the ground and this should be done before the pods are formed. If the plants are older they should be cut off and burned.

#### COCKLE BUR.—(*Xanthium Canadense*, Mill.)

Another weed belonging to the same category is cocklebur or clotbur (*Xanthium Canadense*) well known in Iowa as a troublesome weed.

*Description.*—A coarse, rough annual from one to three feet high, stem marked with brown punctate spots; leaves alternate, cordate or ovate, three nerved, long petioled. Flowers monoeious; staminate and pistillate flowers in different heads, the pistillate clustered below. The involucre of the staminate flowers somewhat flattish of separate scales, receptacles cylindrical. Scales of the fertile involucre closed in fruit two beaked, containing two achenes (seeds). The bur is densely prickly and hispid, the achenes are oblong without pappus.

At the upper end of the involucre are two large prickles. This bur has an excellent means of dissemination for the weed as it readily clings to various animals.

Each bur, as stated above, contains two flowers which develop into the "seeds." The statement is frequently made "that one of these may germinate the first year, and the other lie dormant until a later time." Mr. McCluer under the direction of Prof. Burrill made some experiments to determine this point. He reports this popular theory to be true. They found that if a bur lies in such a position that one seed is up and the other down, the one next to the soil may germinate while the other remains



dormant. This is one reason why the plant is difficult to exterminate.

Prof. Arthur, who made some careful studies of cockle bur germination, gives the following statistics of the germination of the cockle bur.

GERMINATION OF COCKLEBURS IN MOIST SAND.  
Final Data taken July 25, 1895.

Species.	Gath- ered.	Plant- ed 1895	No burs	Total lower germ	Total upper germ	Doubt- ful	Both seeds germ	Lower with upper seed want- ing	Upper with lower seed want- ing
X. Canadense . .	Nov 93	Mar 23	100	59	4	8	0	2	3
X. " . .	" 94	" 23	100	73	9	. . .	1	0	5
X. strumarium . .	" 94	" 23	100	78	4	. . .	1	1	3
X. spinosum . .	May 95	June 8	100	63?	3?	. . .	0	. .	. .

Altogether Dr. Arthur germinated four hundred seeds belonging to three species and they behaved essentially in the same manner. The following table gives the germination of the seeds after their removal from the bur.

GERMINATION OF SEEDS OF *Xanthium Canadense* REMOVED  
FROM THE BUR.

Date.	Lower Seeds				Upper Seeds			
	No. Seeds	Av. Wt.	Germ- inated	Viable on July 25, 1895	No. Seeds	Av. Wt.	Germ- inated	Viable on July 25, 1895
Mar. 23	16	56 mg.	14	2 after 124 ds.	15	47 mg	1	14 after 124 ds
" 28	15	. . . .	14	1 after 119 ds.				
Apr. 10	21	. . . .	16	5 after 105 ds.				
" 23	50	. . . .	36	13 " 93 ds.	50	. . . .	2	46 after 98 ds.

Dr. Arthur concludes that the difference in the action of the two seeds is constitutional being a hereditary character residing in the protoplasm of the embryo.

The writer found in 1900 that occasionally both of the "seeds" may germinate the same season, and Mr. G. M. Lummis found that about one in ten cases both of the "seeds" germinated. In this case, however, one "seed" germinated weak and the other strong.

*Distribution*—Here at Ames the variety is very common along

Delayed Germination of Cocklebur and other paired seeds.  
Proc. Soc. Prom. Agri. Sci. 16: 70.



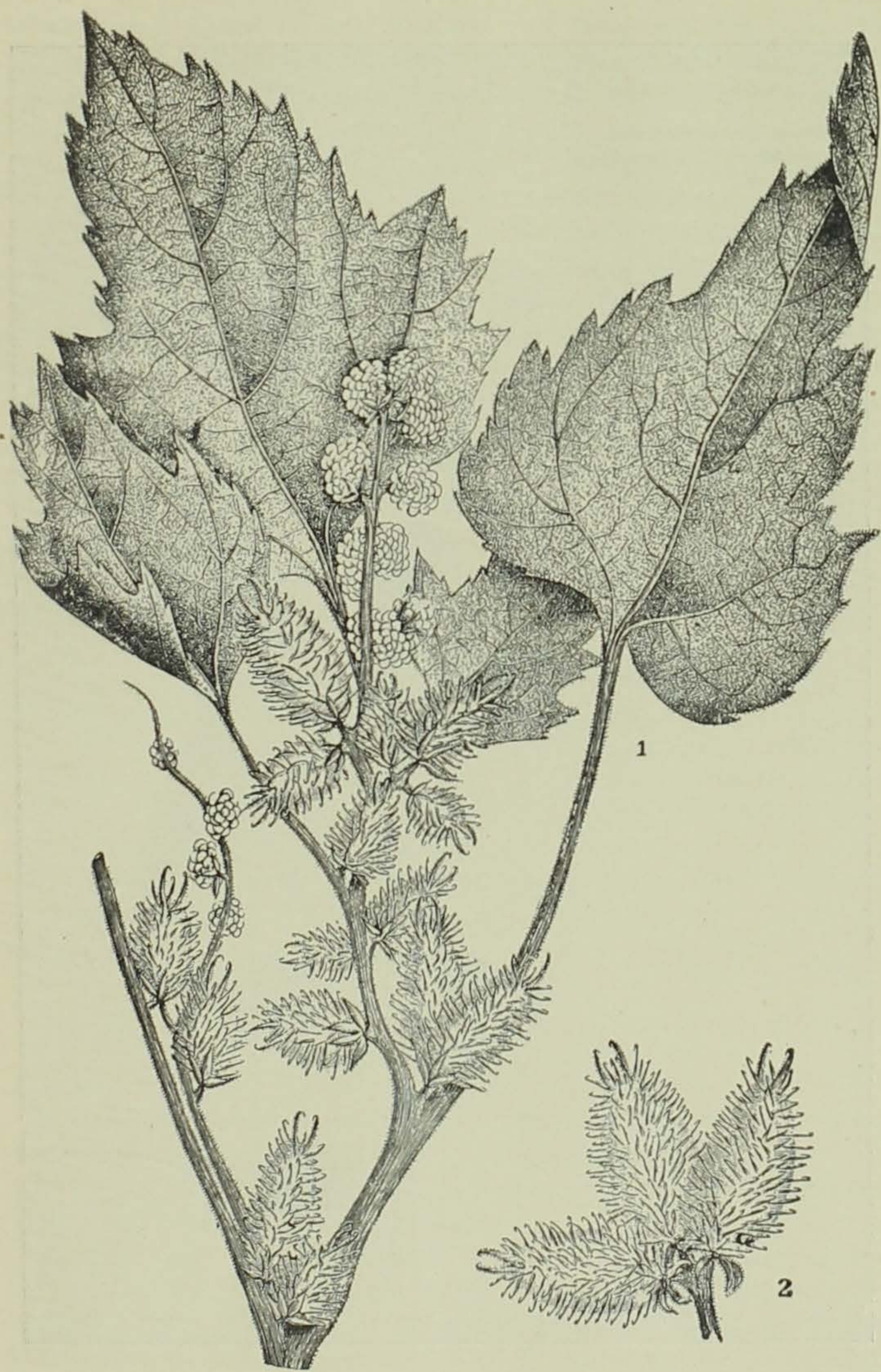


Figure 53. COCKLE BUR, (*Xanthium Canadense*). (Division of Bot., U. S. Dept. of Agriculture).



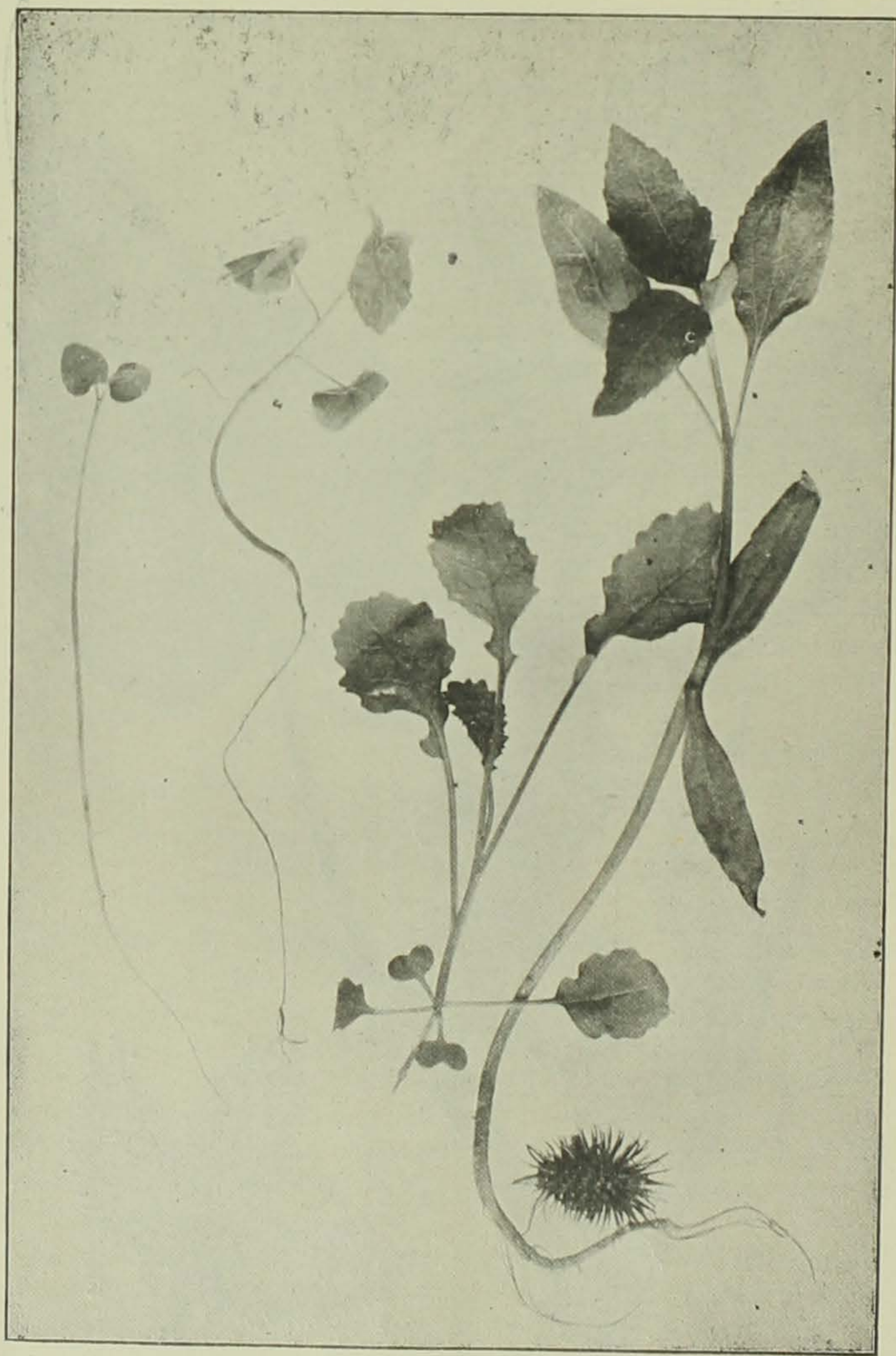


Figure 54. SOME SEEDLING WEEDS, Beginning at the right, Cocklebur, Charlock and two Seedlings of Indian Mallow. (Photo. by Charlotte M. King).



the sandy bottoms of our streams and river courses. In Des Moines it is common in streets. Mr. Stewart informs me that in Adair county it is a common weed in worn out lands. In central Iowa the weed is extremely common in the alluvial sandy bottoms of our streams. It is less troublesome in uplands but here and there it does occasion some trouble even in the central and southern part of the state. However, in southern and southeastern Iowa the weed is often quite troublesome in corn fields, coming up in enormous quantities. This is especially true for Missouri and many of the border counties of the state. In St. Louis it is one of the commonest of the street weeds, and in the Great American Bottom opposite St. Louis we have seen acres of land covered with this weed. It is so thick that nothing else grows. In Texas, too, it appears in the very richest of soil. Its distribution in North America is from Nova Scotia to North Carolina, southwest to Texas and west through Colorado, Utah and Nevada, and north to Assiniboia. Most abundantly developed in the Mississippi valley region from Minnesota to Texas.

*Injury to Stock.*—The injury from this plant probably comes largely from its mechanical action. These barbs sometimes injure the animal as the involucre is probably indigestible. It is said that this weed is injurious to stock. They probably will not eat very much of it. On account of the hooked awns of the involucre the animal may have considerable difficulty in removing them.

According to Chestnut the young seedlings of three species of cockle bur, among them our Canadian cockle bur (*Xanthium Canadense*) are poisonous to hogs.

#### EUROPEAN BINDWEED OR MORNING GLORY.— (*Convolvulus arvensis*, L.)

Another troublesome weed in our corn fields is the European morning glory, *Convolvulus arvensis*. Along with it we will give an account also of our common morning glory which is also widely distributed in our corn fields.

*Description.*—The European bindweed or morning glory is a deep-rooting perennial; stem is procumbent, twining or creeping, and procumbent along the ground. Like the horse nettle, this species propagates freely by underground rootstocks. The leaves are an inch or two long, ovate, oblong, arrow shaped; the lobes at the base running to a point. The flowers are borne

Chestnut Rept. Bureau Animal Industry, 15: 417.



in one flowered peduncles with very small leaf-like bracts some distance from the flowers. Flowers an inch or less long, short broadly, funnel-shaped, white or commonly of a rose tinge.

*Distribution.*—This weed has been known for a considerable length of time in eastern North America where it has been sparingly naturalized for some time. In the sixth edition of Gray's Manual it is stated, "Old fields north Atlantic States." It was



Figure 55. EUROPEAN BINDWEED, (*Convolvulus arvensis*). Charlotte M. King.

certainly common in the gardens in the vicinity of St. Louis in 1886. It certainly existed in Iowa prior to 1889, the writer receiving it from various point in that year. The weed has spread extensively from the original source in that vicinity. Its distribution may be given as Nova Scotia to Ontario, New Jersey, Nebraska and Kansas.

*Extermination.*—This weed may be eradicated just as the horse nettle and the Canada thistle are.



HEDGE BINDWEED OR MORNING GLORY.—(*Convolvulus sepium*, L.)

Hedge bindweed is a troublesome weed in many portions of the state and numerous complaints have been received regarding it.

*Description.*—Smooth, occasionally however pubescent, twin-



□ Figure 56. HEDGE BINDWEED or MORNING GLORY, (*Convolvulus sepium*).  
(Photo. by Charlotte M. King.)

ing around supports or trailing. Leaves triangular, halberd or arrow-shaped, the tip acute, or pointed, the basal lobes obliquely truncate or sinuate lobed. The flowering peduncles four angled with two leaf like bracts which are commonly acute. Corolla is white or tinged with rose purple.

*Distribution.*—The weed is common in Iowa in the moist alluvial bottoms along the Mississippi from New Albin to Keokuk and westward along all the larger and smaller tributaries; less frequent in the northwestern part of the state. It is also found extensively creeping over weeds and other herbaceous vegetation along railroads and roadsides throughout the state. The species is native to North America and is common from Nova Scotia to



Maine, south to North Carolina and Texas to Kansas, Utah, Montana, Minnesota, and eastward. It also occurs in Europe and Asia.

*Extermination.*—The morning glory must be treated like horse nettle since it is a perennial. In addition to the usual methods of cultivation sheep have been recommended to destroy the weed. This method is certainly applicable where the weed occurs in pastures.

## WEEDS OF GRAIN FIELDS

The injurious weeds of grain fields are comparatively few in number. The weeds have been known to cultivators for generations. The tares of the ancients (*Lolium temulentum*, L.) comes to us from Europe and Europe received it from Asia. Mustard was undoubtedly cultivated in Palestine at the time of our Saviour. Corn cockle, vetch and chess are all credited to Europe but no doubt they were early transferred to the countries of Europe from Asia. These weeds have long been recognized as troublesome weeds in many European countries. From the early culture of grain in this country they have been regarded as weeds. It may be interesting to note that these weeds are not so abundant where grain culture is not carried on.

### MUSTARD OR ENGLISH CHARLOCK.—(*Brassica Sinapis*, Boiss.)

*Description.*—Lower leaves nearly divided to the middle, with the divisions unequal, the terminal lobe larger. Upper leaves not stalked as a rule, much smaller than the lower. Flowers yellow, large and very fragrant. Pods one to two inches long, irregular in outline, appearing somewhat nodose, three to seven seeded or more occasionally. The upper part of pod forms the beak. Seeds round, brownish black, darker than in *B. nigra* and minutely pitted. When moistened they become mucilaginous.

*Distribution.*—Dr. Robinson, in giving its distribution, states that it is a common and troublesome weed in cultivated ground from June to August. The form which occurs in America has glabrous pods while in the Old World they are quite as often hispid.

Specimens from Iowa in the Botanical Department of the Iowa State College are as follows: Greenfield, 1892 (F. C.



Stewart); Green, Butler Co., 1891 (L. P. Price); Smithland, Hamilton Co., (P. H. Rolfs); Emmetsburg, 1888 (A. A. Crozier); Elmyra, 1887, and Tipton, 1884, (A. S. Hitchcock); S. Minnesota near Iowa, 1888, (A. A. Crozier); La Crosse, Wis., 1891, (L. H. Pammel.) It has also been collected by B. H. Hibbard (Paullina), A. P. Whitmore (West Union), and Ira Williams (Menlo). Abundant in the following places:



Figure 57. CHARLOCK or COMMON MUSTARD, (*Brassica Sinipistrum*).  
(U. S. Dept. of Agriculture.)



Ames, Belle Plaine, Dakota City, Armstrong, Council Bluffs, Sioux City, Lyons, Chickasaw county, in fact throughout northern Iowa. There is probably not a village or city in Iowa where it does not occur and in smaller places the streets are fairly yellow with it in July and August.

The cultivation of flax in northwestern Iowa is largely responsible for the presence of mustard in corn fields, especially so where alternate husbandry is followed, that is where wheat or oats or barley follows flax. There are many flax fields in northwestern Iowa that contain a larger percentage of mustard than do the corn fields. The fields are practically yellow with mustard. The writer has found as much as five per cent of some samples of oats to consist of mustard.

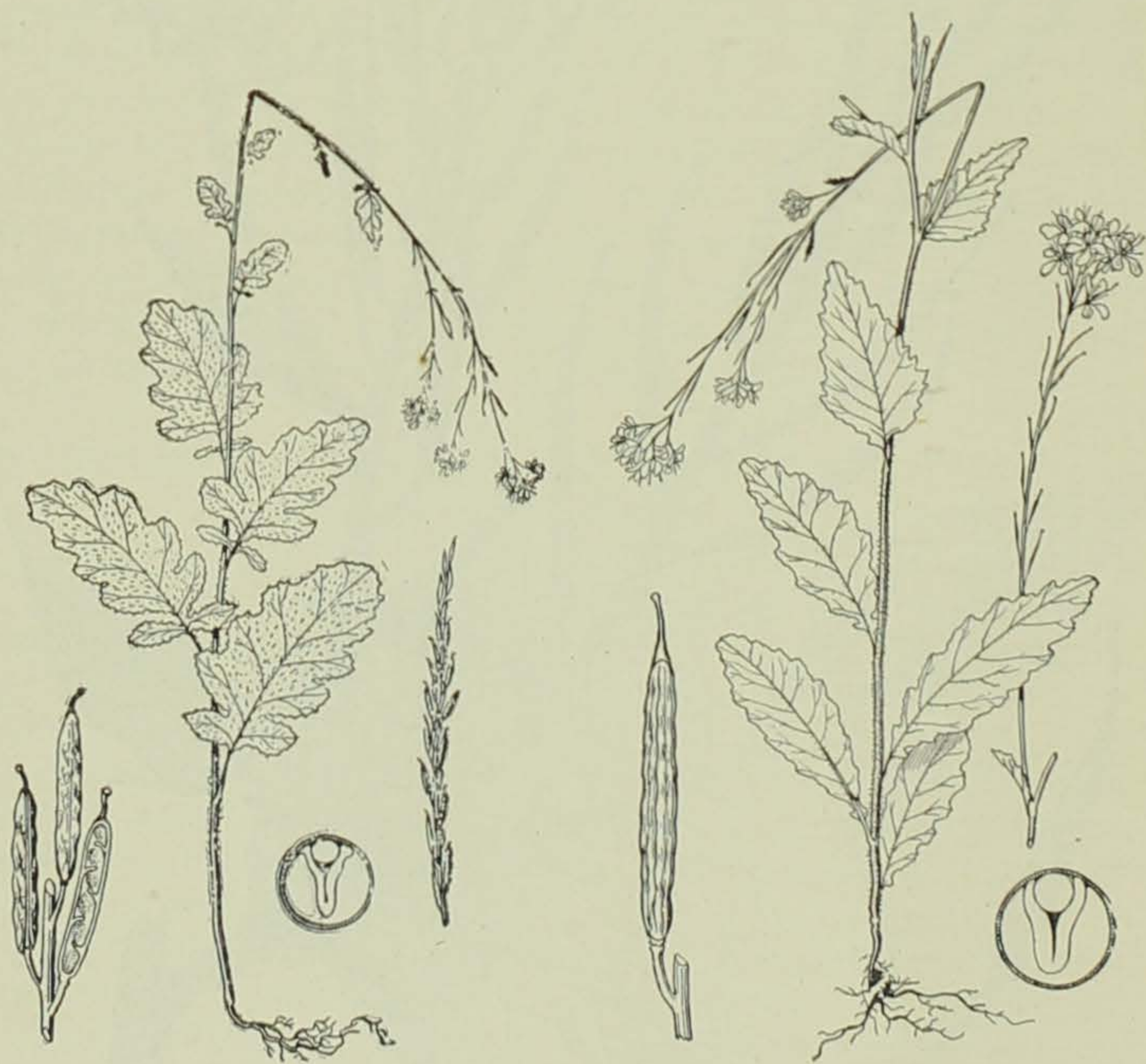


Figure 58. ENGLISH CHARLOCK or MUSTARD, (*Brassica Sinapistrum*) common in grain fields.

Figure 59. BLACK MUSTARD (*Brassica nigra*) common along roadsides and in some fields, (Both figures, Division of Bot. U. S. Dept. of Agriculture).



BLACK MUSTARD.—(*Brassica nigra*, Koch.)

*Description*.—A tall, coarse, much branched annual, two to five feet high; leaves variously divided or only deeply cut, the terminal lobe the largest, sharply toothed. The upper leaves small, simple, as a rule linear. Leaves as a rule not smooth, but somewhat bristly, at least on the veins. Flowers yellow, smaller than in charlock. Pods smooth, about one-half inch long, four-cornered, tipped with a slender beak. Seeds black or reddish brown, smaller than in charlock. Cotyledons incumbent.

*Distribution*.—Dr. Robison gives the distribution as extending across the continent, preferring rich soil. It is common so far as I have observed in Wisconsin, Minnesota, Nebraska, Illinois, Missouri and Colorado. Common at many points in Iowa. Iowa distribution as represented in the Iowa Agricultural College collection is as follows: Ames, 1885, (Esther Crawford); Jewell Junction, 1891, (J. A. Rolfs); Marshalltown, 1891, (F. C. Stewart), Humboldt, 1890; (Geo. Foster); Story County, 1882, (A. S. Hitchcock); Muscatine, (Ferd. Reppert); Cedar Rapids, L. H. Pammel). Though not represented by specimens, I may say that it is common in many parts of Iowa; Ames, Carroll, Council Bluffs, Des Moines, Dakota City, and Clinton.

Its European distribution is as follows: Norway, Sweden, Finland, England, Russia and Germany.

FALSE FLAX.—(*Camelina sativa*, Crantz.)

*Description*.—An erect annual with simple or sparingly branched stem, one and a half feet long, smooth or slightly pubescent, hairs stellate; leaves erect, lanceolate or arrow shaped, entire or nearly so. Flowers small, yellow, pedicels in fruit spreading. Pod obovoid four to six inches long, smooth, reticulated, margined from beak down along placental side with smaller ribs between them. Seeds light brown, one line long, minutely pitted, caulicle prominent, running lengthwise with a prominent groove between it and the cotyledons which are incumbent. On the addition of water the seeds become mucilaginous.

*Distribution*.—It is common in Manitoba, south to Minnesota, Northern Iowa and the Dakotas, where it is well known and a troublesome weed. Story county, 1882 (Hitchcock).

Dr. Robinson states:





Figure 60. FALSE FLAX, (*Camelina sativa*), in grain fields. (Charlotte M. King).



A weed not infrequent in cultivated grounds, especially in flax fields in Canada and the middle states, extending across the continent.

TUNBLING MUSTARD — (*Sisymbrium altissimum*, L.)

*Description.*—A leafy, branched annual from one to four feet high, lower leaves runcinate pinnatifid, irregularly toothed or wavy margined. Upper leaves smaller thread-like.

Mr. Dewey describes the seeds as follows:

The seeds of the tumbling mustard are about 1 mm. (1-25 inch) long and about one-half as thick. They are about the same length as the naked seeds of timothy, but are less pointed and not so thick in the middle. Although generally oblong in outline with rather blunt ends, they vary considerably, some having one scar



Figure 61. TUMBLING MUSTARD, (*Sisymbrium altissimum*). A recently introduced weed. (Photo. by Charlotte M. King.)





Figure 62. TUMBLING MUSTARD, (*Sisymbrium altissimum*), in flower, b. leaf; a root; c. flower. (Division of Botany U. S. Dept. of Agriculture.)

or hollow extending half the length of one side, others having two nearly equal hollows on the same side, extending from opposite ends nearly to the middle, while still others have scarcely any hollow. In some the radicle is very prominent and straight, in others it is curved spirally around the cotyledons, and in some it is so nearly covered by the cotyledons as to be scarcely perceptible.

*Distribution.*—This weed has spread with considerable rapidity in the Northwest. Dr. Robinson states that it was scarcely more than a ballast weed about the large cities of the Atlantic seaboard, and records its occurrence sparingly in southern Missouri (Bush).

Mr. Dewey, who has given us a good account of its distribution, states:

The earliest authentic report we have of this species in America is a specimen in the National Herbarium, collected on ballast ground at Philadelphia in 1878. There are no indications



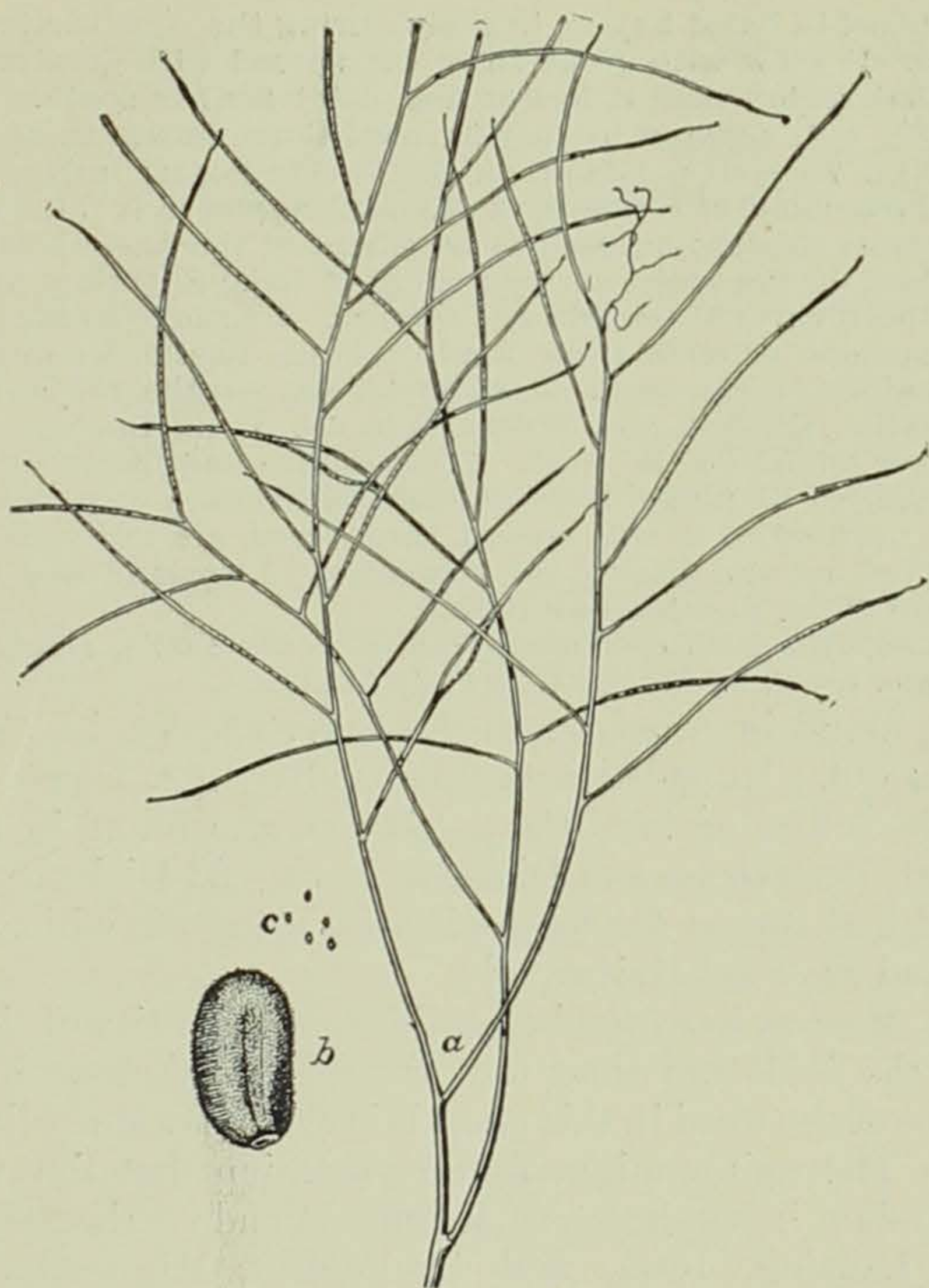


Figure 63. TUMBLING MUSTARD, (*Sisymbrium altissimum*) c. seed natural size; b. seed magnified. (Division of Botany U. S. Dept. of Agriculture.)

that it ever spread from that locality. It is said to have been observed in 1883 along the tracks of the Chicago, Milwaukee and St. Paul Railway at Sheffield, about five miles east of Kansas City, Mo. It seems to have spread slowly in that vicinity until within the last two or three years, and is yet confined to a comparatively small area. In 1892 it was observed at Aberdeen, S. Dak., and its abundance and distribution at that time indicated that it had been present there at least three or four years. In 1893 it was collected at Chicago, and at Weehawken, N. J.; in each case introduced along railroad tracks. In 1894 it was observed first at Minneapolis, and in 1895 it was collected at seven different points within ten miles of that city. It is most abundant about elevators, indicating that it is probably introduced in impure seed which is cleaned in the steam-power cleaners.

The earliest authentic record of the tumbling mustard in Canada is based upon specimens collected in 1885, on the Canadian Pacific Railway, at the eastern base of the Rocky Mountains, in Alberta. It was found soon after this at several points along the Canadian Pacific Railway, and had evidently been in-



roduced in baled hay or in grain during the construction of that road. It grew with great vigor and spread with greater rapidity in that region than it has at any point farther south. It is evidently well adapted to varying conditions, however, as it grows well on Vancouver Island, on the Pacific Coast; in Roger's Pass at the summit of the Selkirk Mountains, where it rains or snows nearly every day; across the dry plains of the Assiniboia; at Port Arthur, on the bleak northern shore of Lake Superior; and in the southern parts of Ontario and Quebec. Its range so far as known at present extends from Roger's Pass, Castle Mountains, and Winnipeg on the north, to Sheffield, Mo., on the south, and from Danville, Quebec, and Weehawken, N. J., on the east, to Vancouver Island on the west. Temperature and moisture have not yet limited its range, and there is every reason to suppose that if left unchecked it will spread throughout all the territory just marked out and dispute the possession of the land with ragweed, ox-eye daisy, and Russian thistle.

I have recently seen specimens from East St. Louis, (Eggert 1896), where it was found by Mr. Letterman in 1896.

It was found in Ames by Prof. G. W. Carver, in 1895, and again in 1896. In addition to this locality, Mr. Dewey reports it from the following localities: "It was also found in 1895, at Davenport, Blue Grass and Dickens, Iowa. At Dickens, in Clay county, it had spread for some distance along the Chicago, Milwaukee and St. Paul Railway."

Mr. H. Morrow has found a considerable quantity of this weed in one of the fields and along the railroad near Ames. From the abundance of the weed in this place it is evidently spreading quite rapidly. The writer might further mention that the weed is quite abundant in southeastern Minnesota and northeastern Iowa between Lansing, Iowa, and LaCrescent, Minnesota. Since writing the above the writer has observed it in Kossuth county.

#### EXTERMINATION OF MUSTARDS.

In these plants it is important to destroy the plants before the seeds have formed. This can be done by pulling the young plants up. This is not always an easy matter, as it may mean the loss of a good many plants of oats, flax or wheat. Still, it is better to suffer a little loss in this direction, than to have all of the mustard plants mature seed. A judicious method of rotation should be followed: flax, wheat or oat fields can easily be freed from mustards by cultivation. Mustards of vacant lots or streets must be removed and this can be done by cutting the young plants off in June and July, and repeating later in the season.

The field once cleared, should be kept so; this can be done only when clean seed is sown. Much of the seed is removed by clean-



ing, some, however remains. It would be well to set aside certain areas for the production of seeds,—these fields kept rigidly clean. If farmers could be induced to follow this system, they would have but little mustard, provided an effort would also be made to plow early in the fall, and induce the mustard seeds in the field to germinate. When the seeds have germinated, run over with a harrow.

Recently in going through sections of eastern Minnesota and western Wisconsin, it was very noticeable that mustards were not common, largely because flax is not grown and clean seed has been used.

I am certain that much of the seed may be removed in this way. There are cases of prolonged vitality under favorable conditions, but these are exceptional. Elsewhere I have quoted Prof. Beal, who found vitality after ten years. It should be remembered that moisture will induce germination, provided the needed amount of oxygen is present.

Mr. R. E. Buchanan in the season of 1902, on the college grounds, carried on some experiments, in treating mustard with a copper sulphate solution. The following solution was used: One pound of copper sulphate to four gallons of water at the rate of 50 gallons to the acre.

#### RESULTS OF SPRAYING MUSTARD WITH COPPER SULPHATE SOLUTION.

July 19. Sprayed thoroughly:

1. Patch of *Brassica Sinapistrum* one square rod, by roadside. In full bloom, some seed set.
2. Patch of *Brassica nigra*, one square rod. In full bloom, much seed set.

July 21.

1. Most of the leaves shrivelled and somewhat dry, blooms and stem not affected.
2. Entire plant somewhat shrivelled and dry.

July 22.

1. Leaves dry and mostly dropped. Stem unaffected. Ripened much seed. Continued to bloom.
2. Entire plant killed, but not before some seed had ripened.



## EFFECT ON OTHER PLANTS GROWING WITH MUSTARD.

Bluegrass (*Poa pratensis*) not affected.

Large Ragweed (*Ambrosia trifida*) not affected.

Prickly Lettuce (*Lactuca Scariola*) was browned somewhat, but not materially injured.

Morning Glory (*Convolvulus sepium*) was browned somewhat but soon recovered.

Burdock (*Arctium Lappa*) leaves killed, but immediately sprang up again from root.

Prof. L. R. Jones carried on some experiments of killing kale with copper sulphate. The use of copper sulphate has also been favorably reported on by Prof. Bolley and others.

Prof. Jones says as follows:

In conclusion, however, we wish to add our conviction, that the preferable way to handle kale and most other weeds in tillable land is, in general not by the use of chemicals but by shorter rotations, more clover and corn, and cleaner cultivation.

SUMMARY OF EFFECTS OF SPRAYING UPON KALE PLANTS.

PLOT	I.			II.			III.			IV.			V.		
Solution used	3% Copper Sulphate			3% Copper Sulphate			3% Copper Sulphate			3% Copper Sulphate			3% Copper Sulphate		
Date when Sprayed	June 13			June 13			June 13 June 23			June 23			June 23		
No. Kale Plants when Sprayed	136			130			115			92			86		
Condition of Kale Plants on following dates.	Uninjured	Affected	Dead	Uninjured	Affected	Dead	Uninjured	Affected	Dead	Uninjured	Affected	Dead	Uninjured	Affected	Dead
June 15	3														
June 28	31	73	32	18	66	46	17	87	1						
July 5	31	53	52	18	60	62	17	15	83	11	21	58	19	9	58

Vt. Agrl. Exp. Sta. 13: 284. See also other reports of this station.

Prof. Bolley. Proc. Prom. Agrl. Sci. 20.





Figure 64. CORNCOCKLE. (*Lychnis Githago*). Common in Grain Fields. (Chestnut Division of Botany, U. S. Dept. of Agriculture.)

CORN COCKLE.—(*Lychnis Githago*, Lam.)

One of the most common weeds found in our grain fields is corn cockle. Abundant throughout the northern states where wheat is grown. It is a native of Europe and appears to be quite as noxious there as in the United States and Canada. Seeds form a large constituent of the so-called wheat "screening" from the Northwest.

*Description*.—A hairy annual weed, clothed with long, soft hairs. Leaves linear-lanceolate, acute or long-acuminate; flowers are purple and long peduncled; calyx lobes long, linear, surpassing the purple red petals; seeds large, roughened and black.

*Distribution*.—This plant is widely distributed from Nova Scotia to Quebec, and south from New England to the southern states, and westward and northward generally in wheat growing



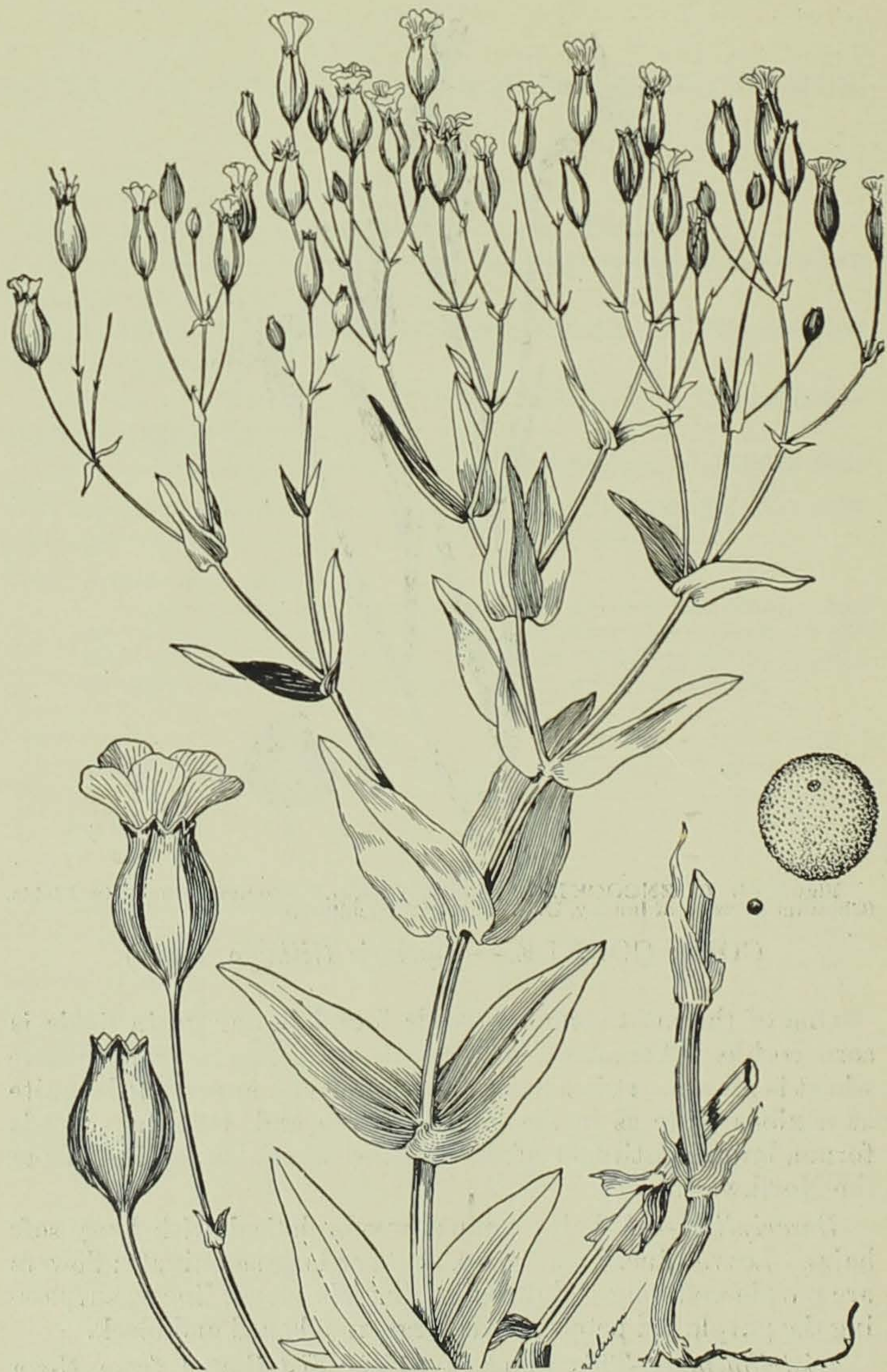


Figure 65. COW HERB, (*Saponaria Vaccaria*). The seed of this weed commonly found in screenings. (Chestnut and Wilcox Division of Bot., U. S. Dept. of Agriculture.)



sections. The plant undoubtedly was native to the oriental countries but has been spread by means of wheat culture. It is not to be wondered at that this weed has become so generally scattered in wheat growing regions as the seeds are somewhat difficult to screen by the ordinary methods. These screenings are much used in feeding stock in some places. The farmer often sows cockle with his wheat.

*Extermination.*—This weed is an annual and in order that it may be checked in its spread use only clean seed. The seed should be put in clean soil.

*Seeds poisonous.*—It has been asserted in Europe that corn cockle in flour and breadstuffs is injurious to health. Nevinny who has examined six or seven hundred samples of flour, found that 106 of these contained impurities, and that 19 per cent contained corn cockle seed, the amount ranging from one-fifth to two per cent. According to the Experiment Station Record, "A person eating 1,200 grains of bread made from flour containing only one-half per cent of corn cockle seed would consume six grains of cockle seed, an amount which the author believes beyond doubt to be poisonous in its effects." The poison in corn cockle is *Sapotoxin* and is partially decomposed while baking, but nevertheless some of it remains and the use of flour which contains corn cockle should be forbidden.

#### COW HERB.—(*Saponaria Vaccaria*, L.)

Cow Herb is another important constituent of "cockle" in wheat screenings, and like the preceding weed has been largely spread by means of wheat culture.

*Description.*—A glabrous annual from one to two feet high with opposite ovate lanceolate leaves. Flowers in corymbed cymes; calyx 5-angled, enlarged and angled in fruit; petals pale red.

*Distribution.*—Common in Europe. Found in wheat fields of the east and as far west as Missouri and Kansas, and the Rocky Mountain region, and wheat regions of the northwest.

*Extermination.*—Clean seed sown in clean soil is the only method of exterminating the weed.

#### COMMON VETCH.—(*Vicia sativa*, L.)

This is another weed commonly found in wheat screenings, abundant in the northwest.



*Description.*—A smooth or slightly pubescent annual from one to two and a half feet high with simple stem. Leaflets 5-7 pairs, obovate-oblong to linear notched or mucronate at the tip. The one or two nearly sessile flowers are borne in the axils of the leaves, corolla violet purple. Pod linear, several seeded, seeds black.

*Distribution.*—From eastern Canada to Northwest Territory, New England to the Carolinas, west to Missouri and northward,

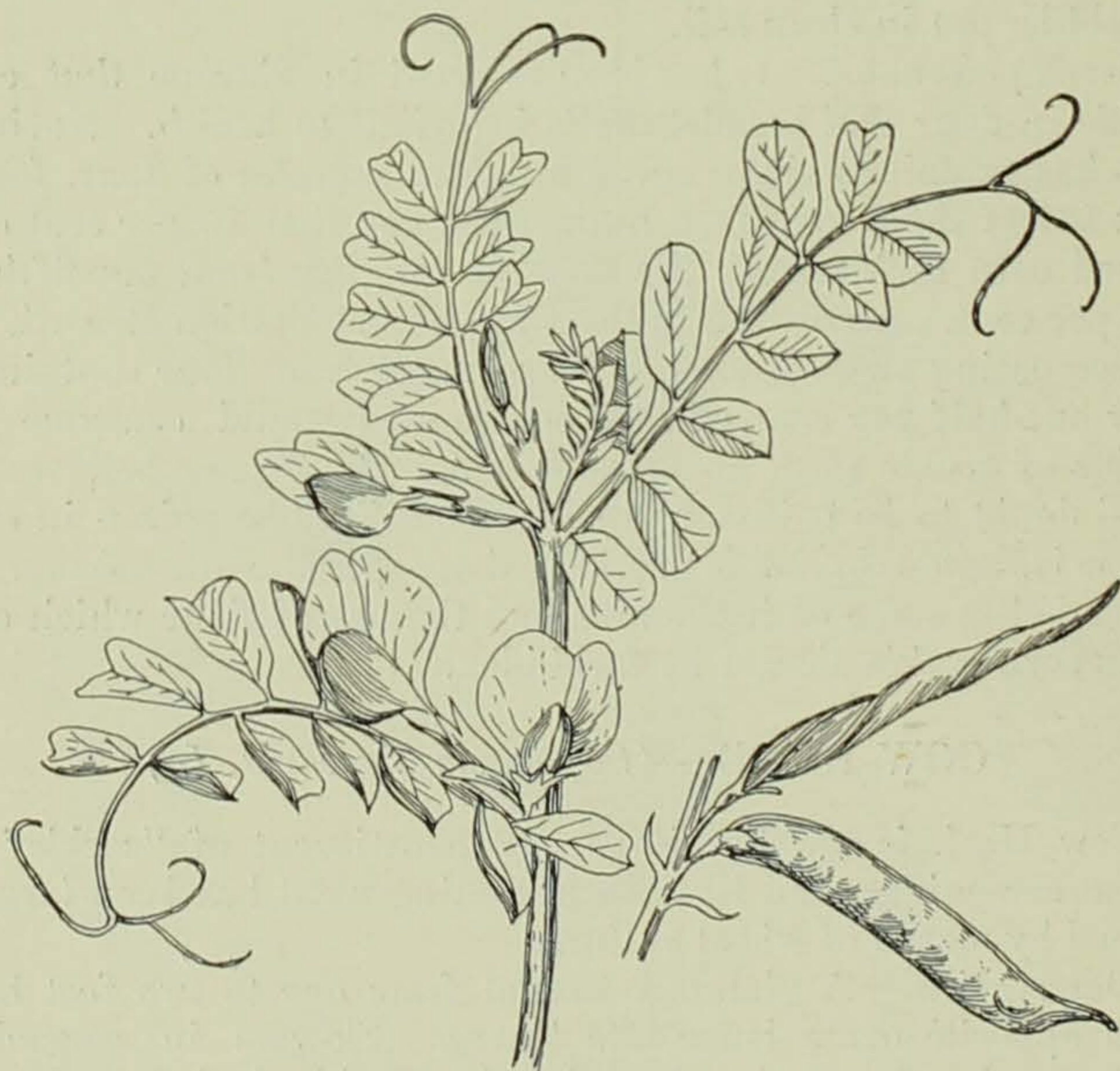


Figure 66. COMMON VETCH, (*Vicia sativa*). The seed commonly found in wheat screenings.

generally in the wheat growing sections of the northern and western states.

*Extermination.*—Clean seed sown in clean soil is the only method of removing the weed.

RUSSIAN THISTLE.—(*Salsola Kali*, *L. var. Tragus*, *D. C.*)

The Russian thistle as a weed in grain fields is not nearly so serious in Iowa as it is in the Dakotas and Minnesota. Never-



theless it is somewhat troublesome in northwestern Iowa.

*Description.*—An herbaceous, smooth or slightly pubescent annual, diffusely branched from the base, from one and a half to three feet high, spherical in the mature form. Leaves fleshy,

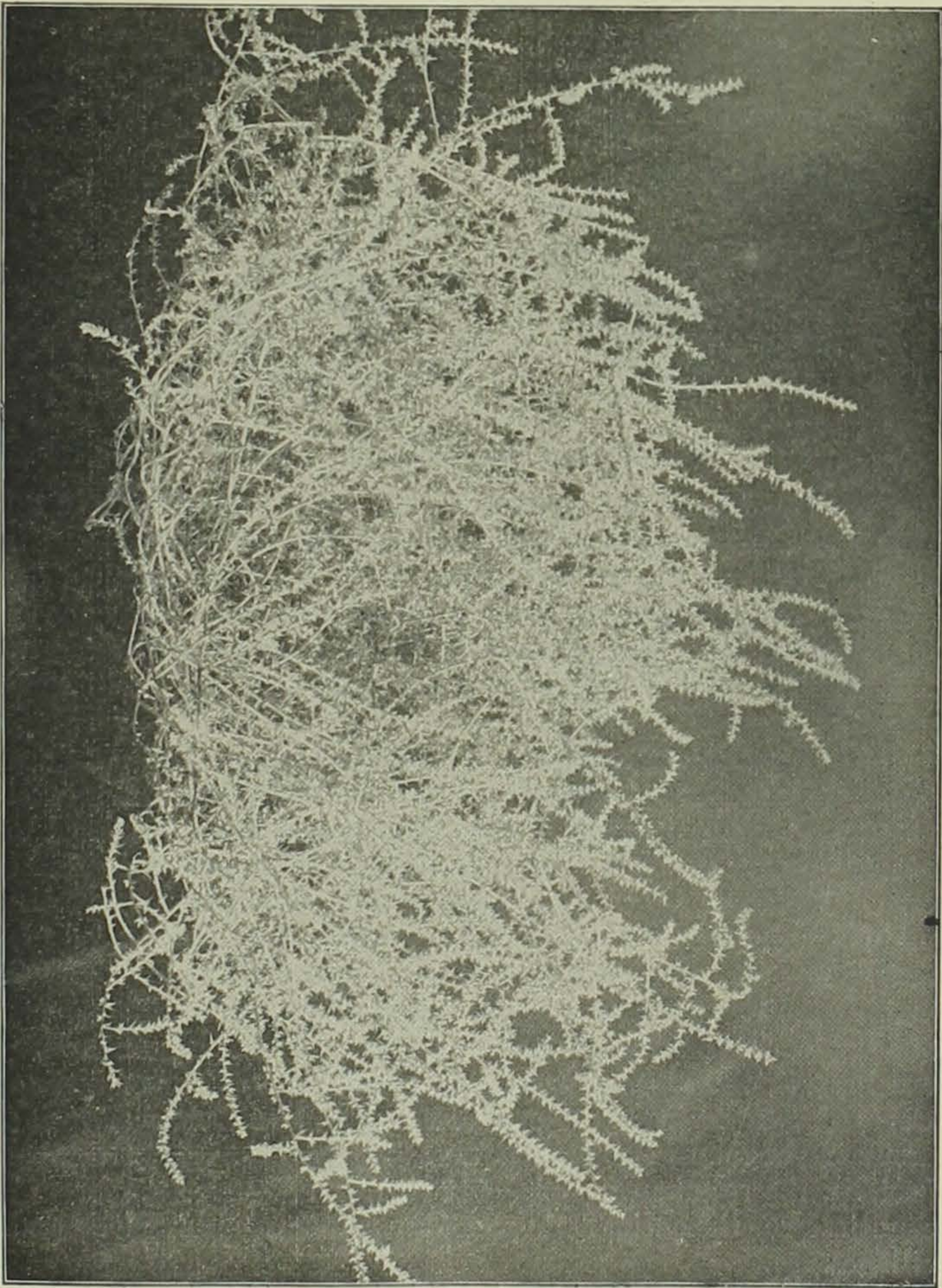
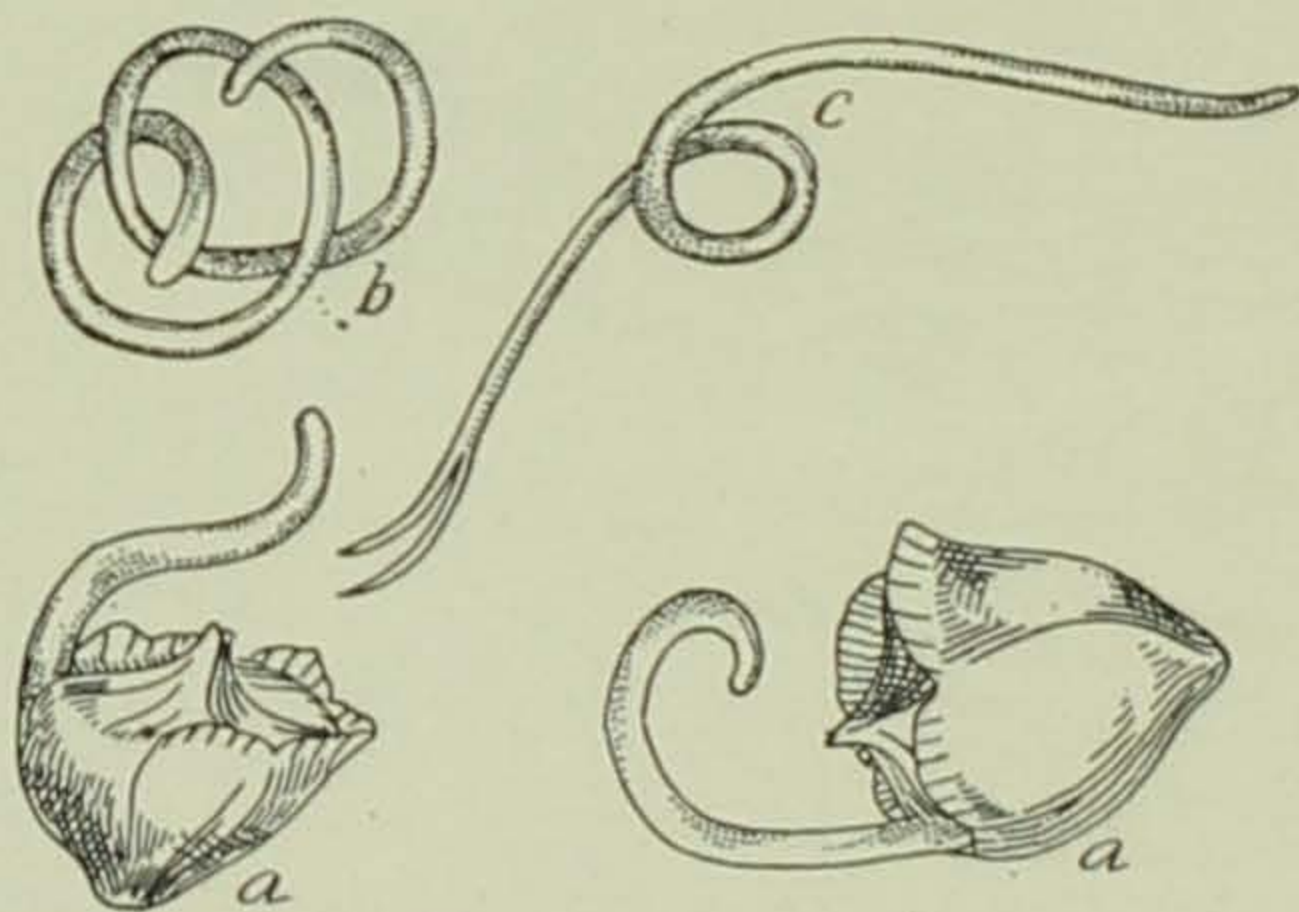


Figure 67. RUSSIAN THISTLE, (*Salsola Kali* var. *Tragus*). A common tumble weed. (Dewey Division of Bot., U. S. Dept. of Agriculture).



alternate, succulent, linear sub-terete, one to two inches long, pointed in the older specimens. Upper leaves in the mature plant persistent, each subtending two-leaf-like bracts and a flower. Stem and branches red. Apetalous flowers solitary and sessile. Calyx consisting of five persistent lobes, enclosing the



Russian Thistle seed germinating. (Carver).

dry fruit which is usually rose colored, about one-twelfth of an inch long. Five stamens nearly as long as the calyx; pistils simple with two slender styles producing a single obconical depressed seed, dull gray or green, without albumen. The embryo is spirally coiled. On germination the cotyledons are subterete. The plant flowers in July or August. The seeds mature in August.

*Distribution.*—It is native to eastern Europe and western Asia. The seed was first brought into South Dakota, and so well did the plant adapt itself to the plains that it has now spread to nearly every state west of the Mississippi river and many states east. It is one of the most characteristic plants of the western plains where its habit of rolling has enabled it to be scattered far and wide. The weed is a conspicuous feature of the west, plants making their appearance along the railroad embankments, streets and fields. It has, however, spread very little beyond northwestern Iowa in this state, being found chiefly from Lyon county to Cerro Gordo county on the east, southwest to Pottawattamie; occurring of course also extensively along the Mississippi river, especially the sandbars. It is found here and there in scattered counties over the entire state along the railways and in cities and villages.

*Extermination.*—The Russian thistle, as said before, is an an-

Dewey. Bull. Dept. Bot., U. S. Dept. Agrl. 15.



nual, hence it would seem an easy matter to destroy it. And as a matter of fact, when taken in time, it is not a difficult weed to remove. Its noxiousness comes largely from the fact that the plant is so productive. If a Russian thistle is once cut off at the

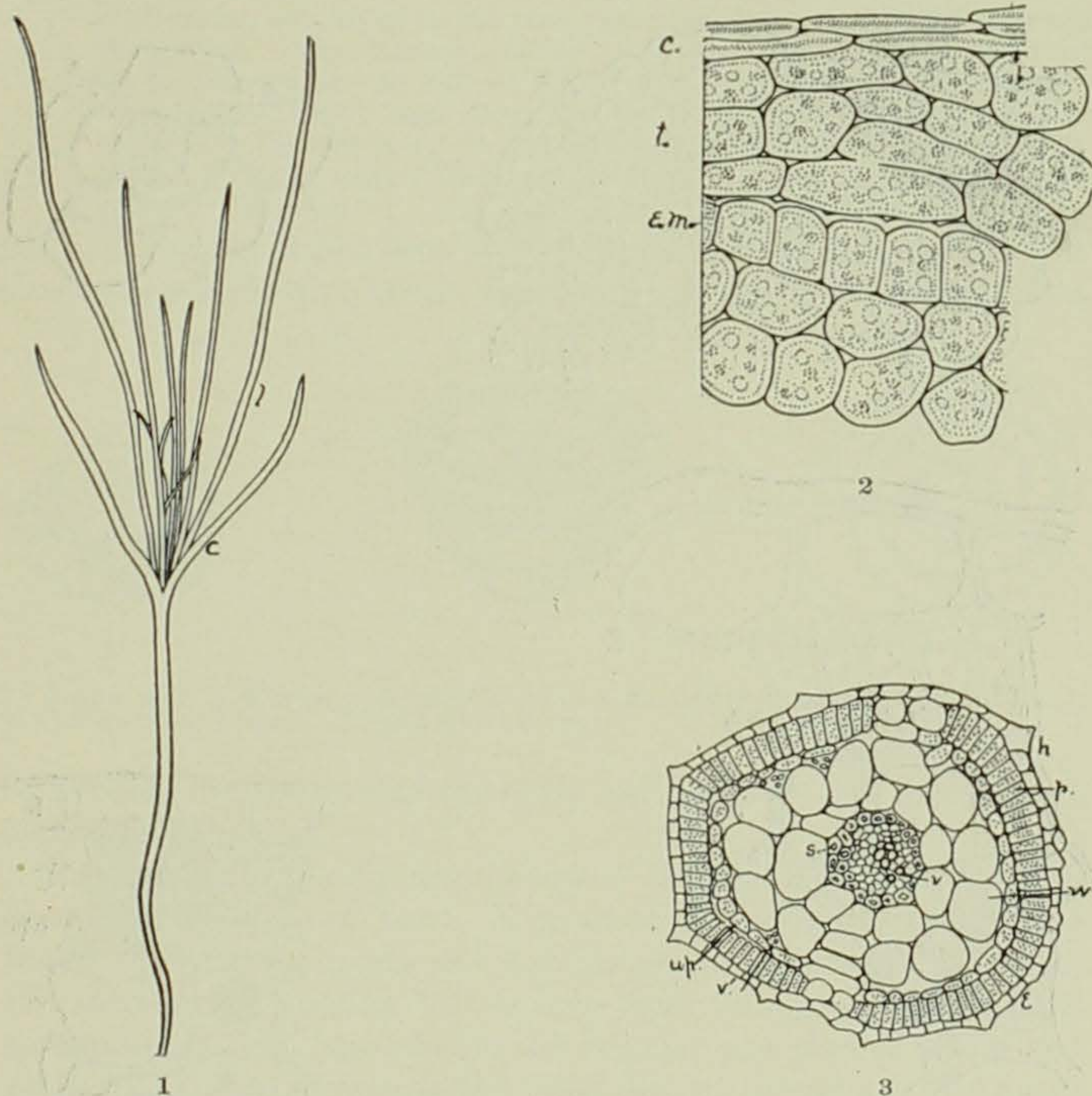


Figure 67A. 1. Young Russian Thistle (*Salsola Kali* var *Tragus*). 2. Cross-section of seed of Russian Thistle. 3. Cross-section leaf of Russian Thistle.

surface of the ground it never grows and hence in all cultivated fields it is not likely to prove a great pest. The question is, however, a very different one in pastures, meadows and roadsides; here the weeds cannot be removed by cultivation and many of the plants mature their seeds unobserved. The removal of the weeds along the roadsides is important, because it is largely from this source that our fields become infested, and the removal of the weeds along the roadsides can best be accomplished by running



over the patch with a mower. It ought, as a matter of fact, become the regular practice of the road overseer to kill the weeds along the roadside at least once a year and this ought to be done in July, when the plants are in flower or earlier. In pastures it would be well to follow the same plan, only one should take into

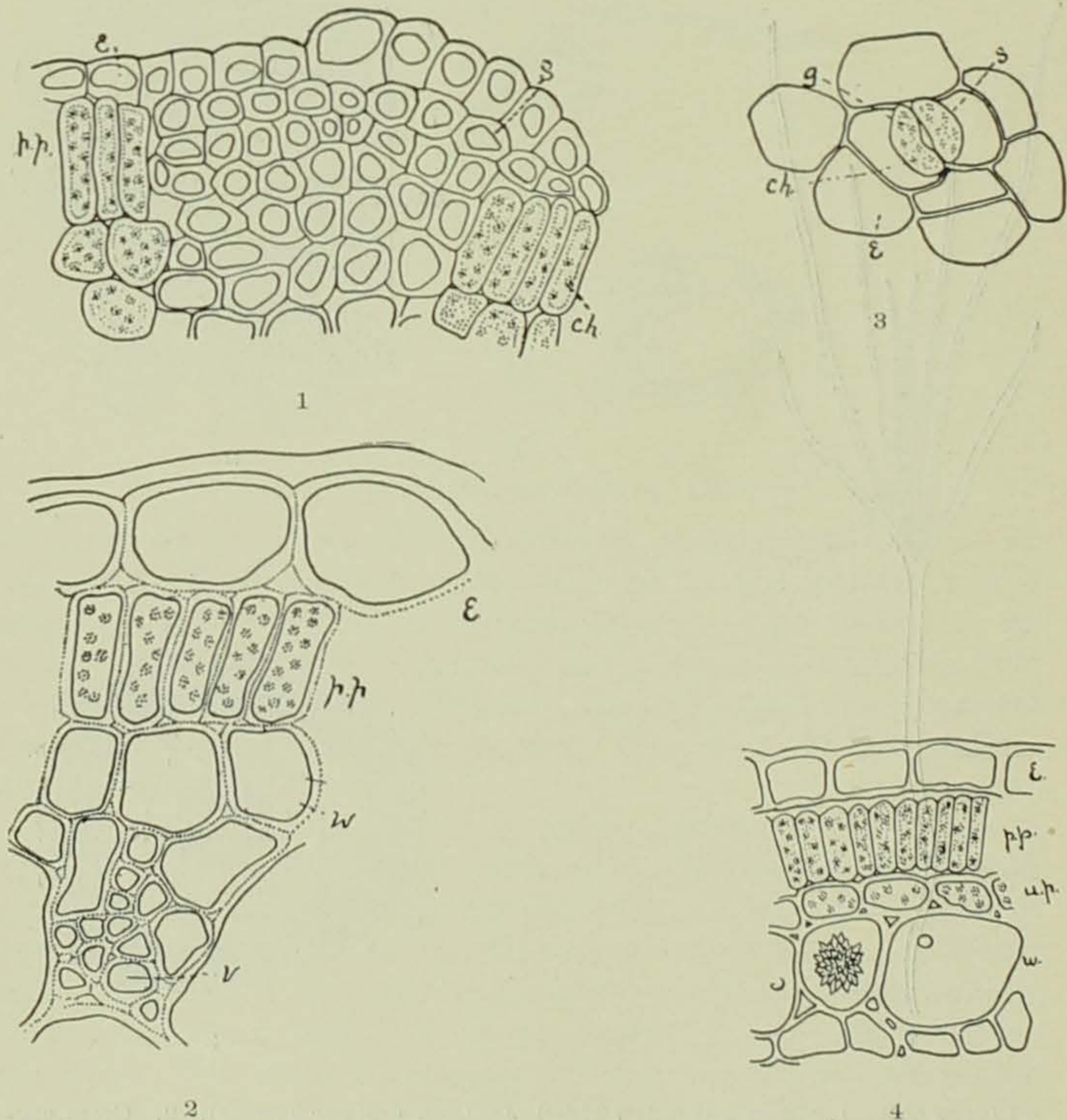


Figure 67B. 1 and 2, A magnified view of Russian Thistle leaf. 3, Stoma of Russian Thistle leaf. 4, Russian Thistle leaf with crystals. (Charlotte M. King).

consideration that many of the small weeds will remain unobserved or perhaps cannot be touched with the mower. In meadows there is not usually very much danger, because the weed requires the open, free ground, and in well regulated meadows the open, free ground is not common, or at least should not be. It is also important to consider in this connection the methods of extermination after the seeds have once formed. In speaking of the dis-



tribution of the weed the statement was made that fences, hedges and wind-breaks were effective barriers against its further spread.

Mr. Dewey says:

Tree planting has been advocated, and if the methods of weed eradication employed in the past years are to be used, trees may aid somewhat. The timber claims throughout the greater part of South Dakota are so full of Russian thistle that it is impossible to cultivate them, and they become a source of distribution instead of a barrier to it. A good growth of timber would certainly retard to some extent the rolling plants, but it would not be an effective barrier.

On this point it has been stated further that sunflowers would constitute an effective break, and being an effective break it would

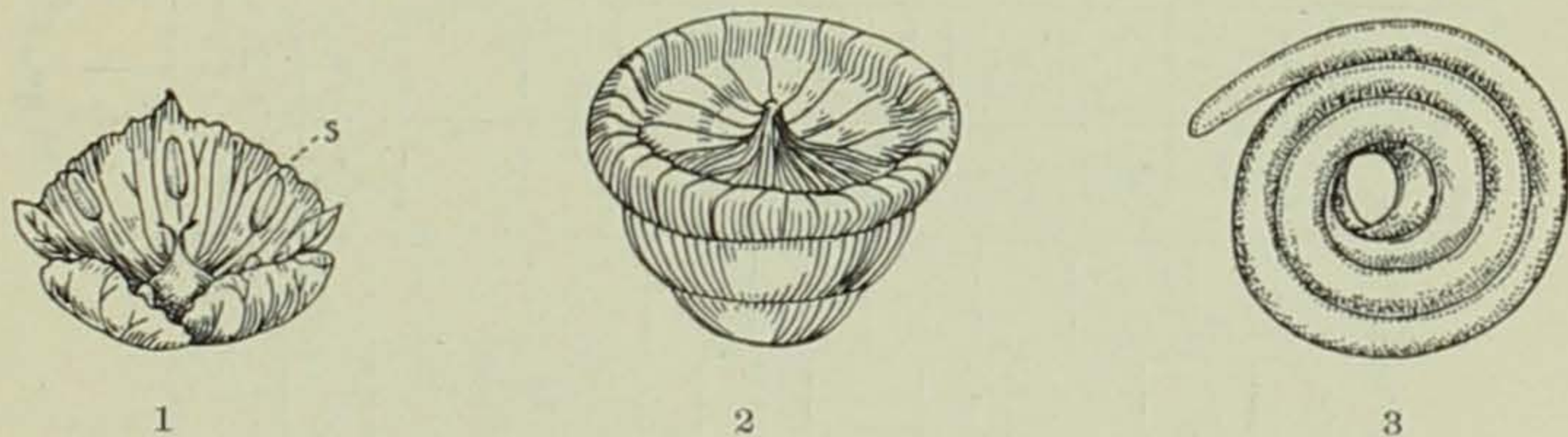


Figure 67C. 1. Flower of Russian Thistle. 2. Seed of Russian Thistle. 3. Embryos of Russian Thistle Seed. (In part after Dewey).

be an easy matter during the early spring to set fire to the large masses so collected.

*Railroads and the Extermination of the Weed.*—In our experience over the state of Iowa, Minnesota and Wisconsin, we have found that the railroads are very much more careful in the observance of the Russian thistle laws than the people of the same communities. It has become the regular practice of all of our great trunk lines to remove the weed during the month of August by mowing and setting these weeds on fire. It is true that sometimes these weeds are overlooked, but, as a matter of fact, the vast majority of the weeds are destroyed in this way. The railroads in the states of Nebraska and Iowa, especially in the infested districts, have kept a large force of men at work to remove the weeds, and yet, some of these weeds frequently escape the attention of the men who are supposed to remove them.

*Cities and Towns.*—The most frequent source of danger of the Russian thistle today comes from the cities and towns. The vacant lot with its unsightly weeds is a seed farm for the Russian thistle. Stock yards and streets are well adapted for the growth and preservation of this noxious weed since the vast majority of



cities and towns pay but little attention to destruction of weeds, for, when the matter is brought to their attention it is too late to destroy the seed, as they have fully formed. I regard the danger coming from cities and towns as a very great one.

*Future of the Russian Thistle in Iowa.*—The laws of the state

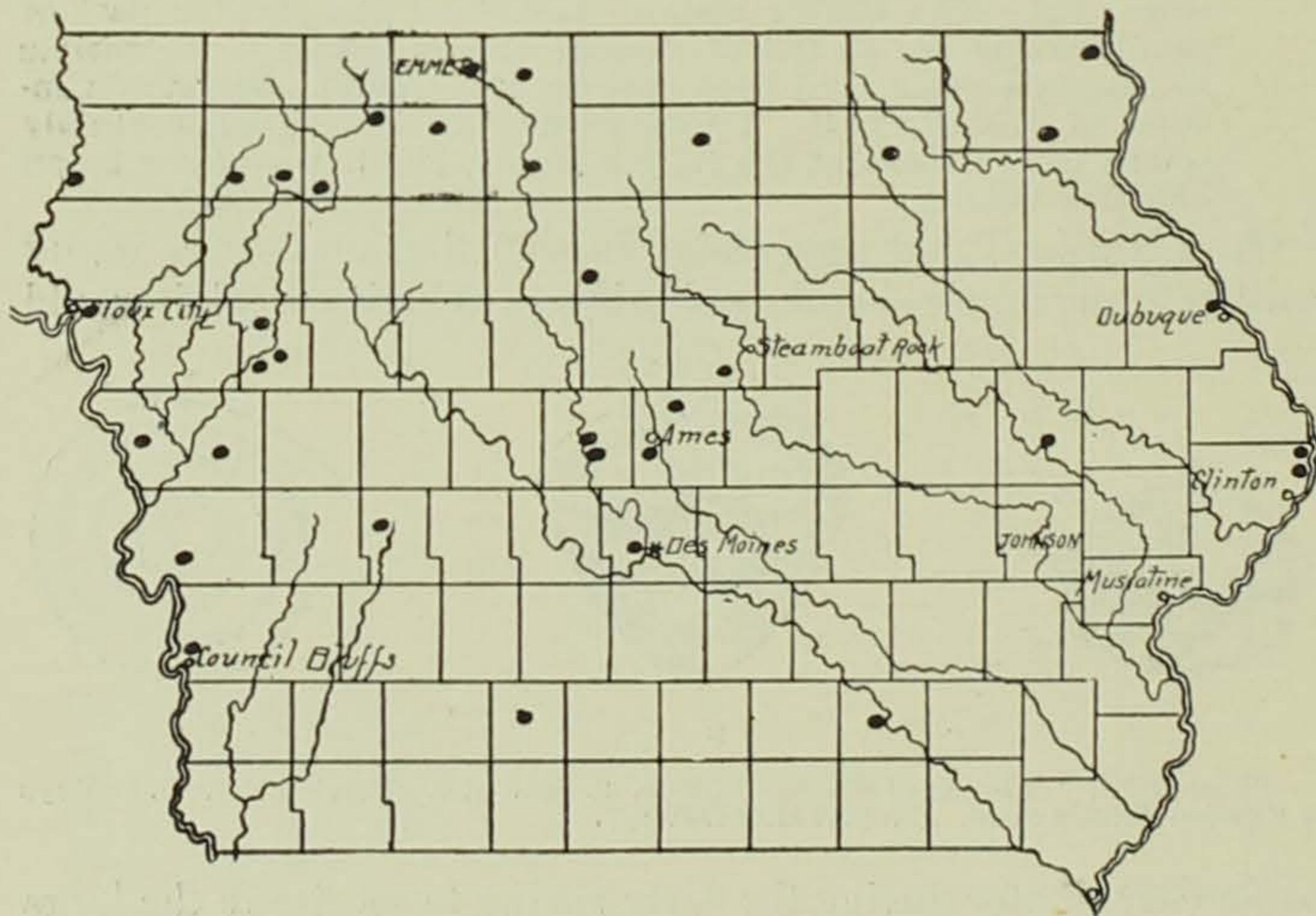


Figure 68. Russian Thistle (*Salsola Kali* var. *Tragus*). (From specimens in the Herbarium, Iowa State College).

of Iowa compel owners or occupants of land to remove the Russian thistles, and so far as the railroads are concerned it has been rigidly enforced.

### MILK WEED.

Several of the milk weeds are troublesome weeds in grain fields, two species especially, the common milk weed (*Asclepias cornuti*, Decaisne and the *A. speciosa*, Torr.)

*Description.*—Common milk weed, *Asclepias cornuti*, is a perennial herb with a stout stalk from two to five feet high, finely, soft, pubescent or tomentose, leaves oblong, oval or ovate, obtuse or roundish at the base, the young leaf somewhat pubescent above, soon becoming glabrate. Petioles stout, and flowers, borne in umbels from a few to many, peduncles pubescent or tomentose, corolla dull purple or greenish purple, occasionally pale in



color. Fruit is a follicle and is borne in erect pedicels.

*Distribution.*—This species is widely distributed in the north, occurring in waste places. New Brunswick, to Saskatchewan, along Atlantic coast to North Carolina and south and west to Missouri and Kansas.

*Description.*—Showy milk weeds (*Asclepias speciosa*) is a perennial from one ot four feet high, white tomentose or can-

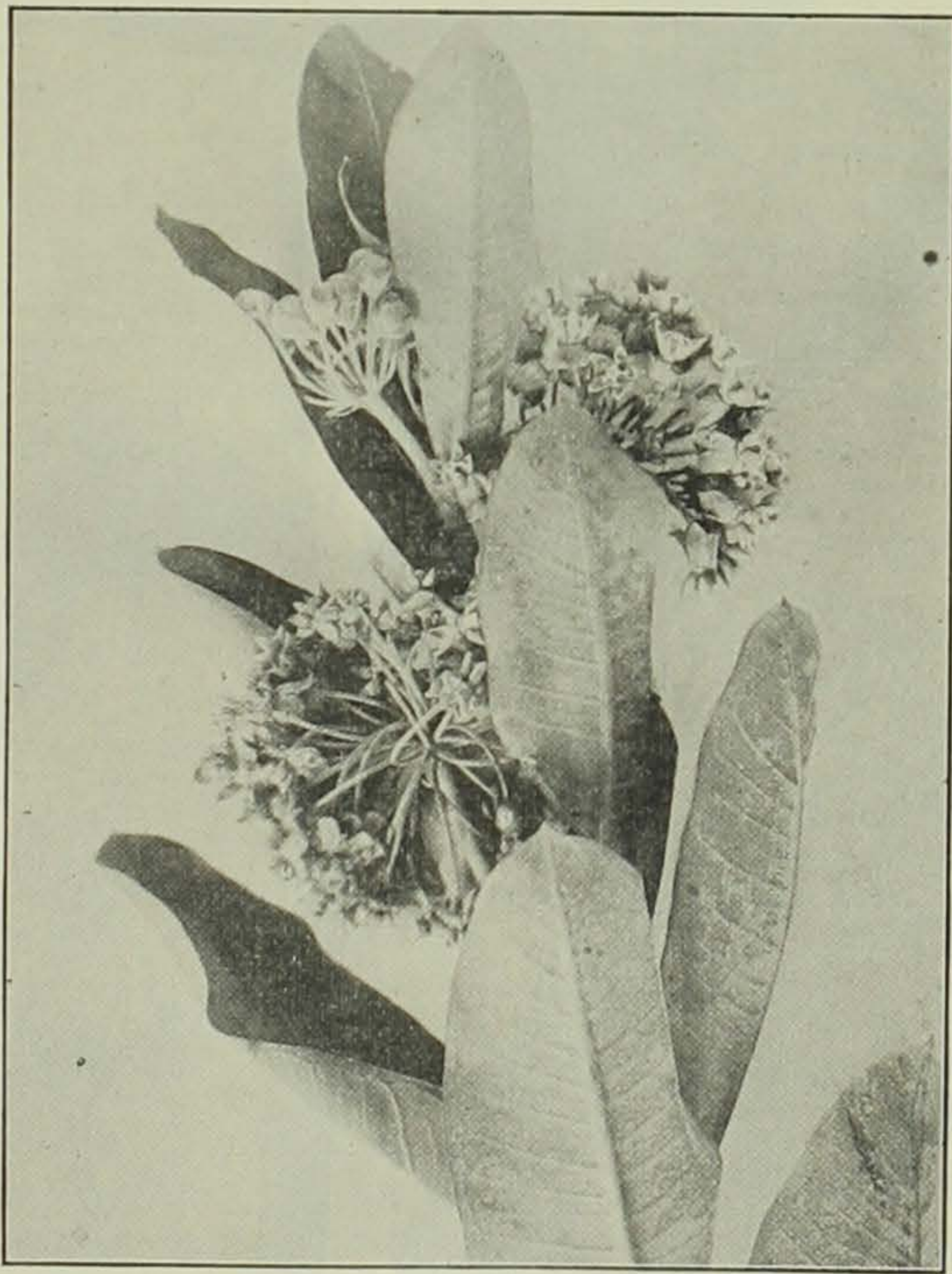


Figure 69. MILK WEED, (*Asclepias cornuti*). A common weed in grain fields, gardens, etc.

escent. Leaves thick, broadly ovate or oval, petioled; pedicel glabrate above, flowers borne in dense umbels or rarely solitary, the pedicels stout; corolla purplish green, large; follicle erect or spreading on the recurved pedicels.

*Distribution.*—Moist soil from Minnesota and northern Iowa to Kansas, in the Rocky Mountain region, common in Colorado,



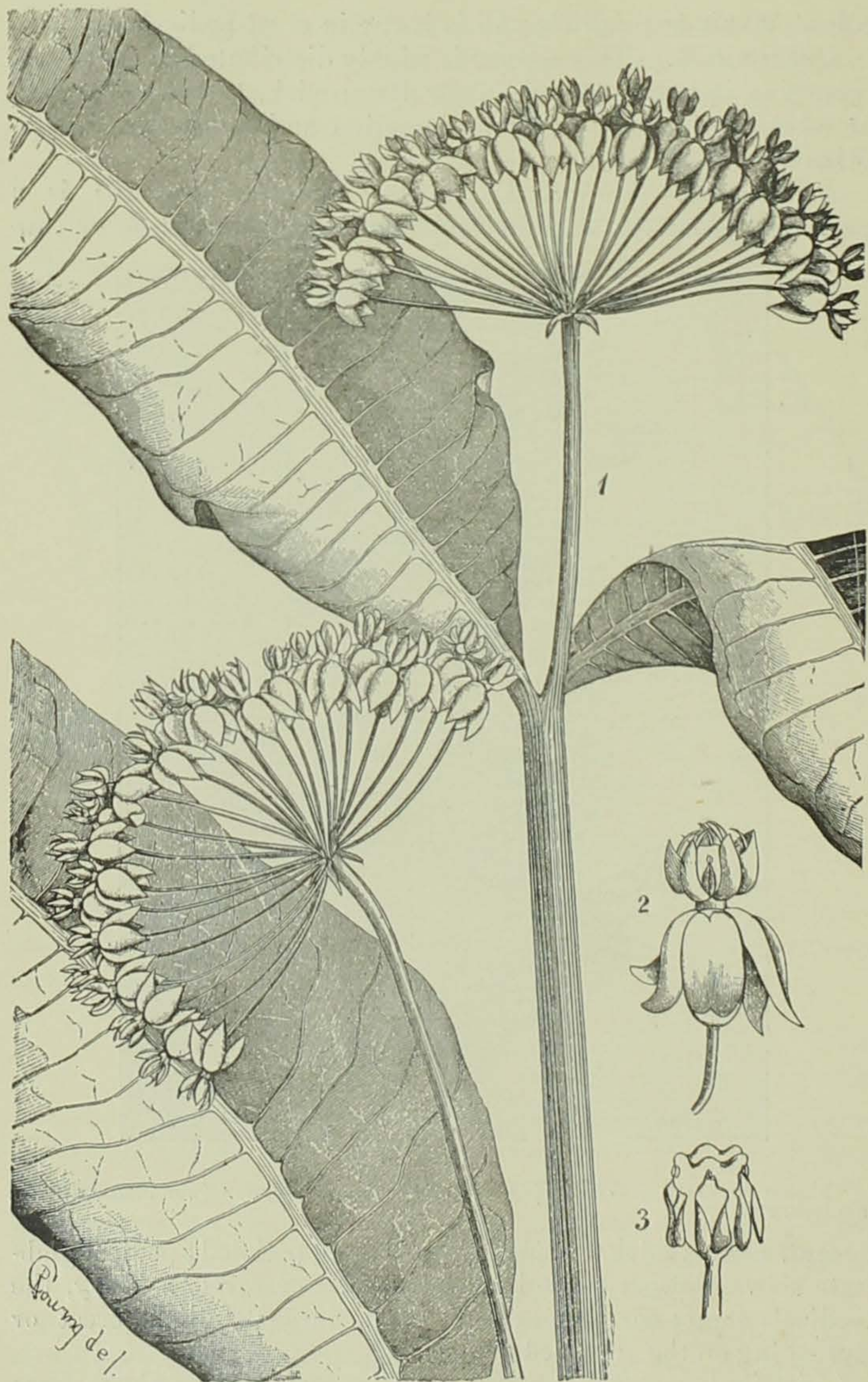


Figure 70. COMMON MILK WEED, (*Asclepias cornuti*). A common weed in grain fields, gardens, etc. (U. S. Dept. of Agriculture).



Wyoming and Utah, a troublesome and pernicious weed.

*Extermination.*—These weeds are troublesome not only in our meadows but occasionally also in grain fields and gardens. In the extermination of these weeds it is best to follow the methods given for horse nettle or Canada thistle.

## WEEDS OF CLOVER MEADOWS.

The weeds found in clover meadows vary greatly, depending upon the locality. The origin of the seed also determines the kind of seed that may be found in the meadow. Many of our worst weed pests have been introduced with seeds of various kinds. In 1891 (Bull. Ia. Agri. Exp. Sta. 13:72) I called attention to several bad weeds on the college farm in the following language: "A good illustration of the introduction of weeds with agricultural seed came to my notice last year. In several clover patches on the farm both Ox-eye Daisy and Ribgrass came up in good numbers. Ribgrass, so far as I know, had not been known on the college farm before, in such numbers.

Ribgrass is also known as Ripplegrass, Ribwort, English Plantain, Buckhorn, Plantain, etc. The botanical name of the weed is *Plantago lanceolata* L. It is an European plant, but now not uncommon in the east and some parts of the south. It is a perennial, bearing numerous long (6-10 inches) leaves close to the ground. The flower stalk is groove-angled from one to two feet long, which bears a cylindrical spike of flowers, at first short but ultimately elongating. Two brownish seeds are found in each vessel. Recently several botanists have called attention to the occurrence of this weed in considerable numbers in clover.

The second weed making its appearance in that clover patch was the Ox Eye Daisy, also known as White Daisy, Daisy White Weed—botanical name is *Chrysanthemum Leucanthemum* L. It has long been known as a pestiferous plant in the eastern states. It is a perennial, producing an erect stem bearing a large head of white flowers on the margin and small yellow flowers in the interior. This head is ordinarily called the flower, but in reality it is a collection of small flowers. Another plant belonging to the composite family, a species of *Hieracium* or Hawkweed, was found several times. It appeared to be *H. aurantiacum*, L, an European weed, which has occasioned some alarm in New York and New England. Like the others it is a perennial.



The flowers are deep orange or flame color. Some other weeds appeared in the same field, but they are not likely to be troublesome."

Later Mr. F. C. Stewart noting the great abundance of weeds in clover meadows in all parts of the state undertook an investigation of the impurities of clover seed. He examined in all 84 samples of clover, 57 of which were grown in Iowa, 8 in Ohio, 3 in Illinois, 7 in New York, 2 in Michigan, 2 in Minnesota and 1 each in Missouri, Wisconsin, Nebraska, New Jersey and Indiana. Of the 84 samples examined 11 were practically pure, containing only from one to six pieces of foreign matter of any amount in 5 grams. Many of the samples sent from the eastern states contain such weed seed as plantain, sorrel, dock, etc. One of the eastern firms claims to have machinery which will make the clover seed absolutely pure.

Mr. Stewart found the following percentages of impurities.

PERCENTAGE OF IMPURITIES			
Where Grown	Percent of Impurities	Where Grown	Percent of Impurities
Dallas County, Iowa.....	67.0	Colfax, Iowa .....	2.4
Iowa.....	35.2	Perry, Iowa .....	2.4
Michigan .....	28.3	Creston, Iowa .....	2.3
Odebolt, Iowa .....	26.8	Elburn, Iowa.....	2.2
Odebolt, Iowa .....	26.3	Waukesha, Wisconsin .....	2.0
Cerro Gordo Co., Iowa .....	12.5	Keoduk, Iowa ...	2.0
Northern Missouri.....	10.6	Indianola, Iowa.....	1.9
Story County, Iowa.....	8.6	Prairie City, Iowa.....	1.8
Van Meter, Iowa .....	9.1	Ames, Iowa .....	1.7
Panora, Iowa.....	7.5	Baxter, Iowa.....	1.7
Walnut, Iowa .....	7.2	Minnesota.....	1.6
Blanchard, Iowa .....	7.2	Franklin County, Ohio .....	1.5
Lorimore, Iowa.....	7.1	Marengo, Iowa .....	1.5
Otley, Iowa .....	6.5	Fairfield Co., Ohio.....	1.5
Livingston Co., N. Y.....	6.4	Mt. Zion, Iowa .....	1.4
Ladora, Iowa.....	5.8	Elgin, Iowa .....	1.3
Hampton, Iowa.....	5.7	Farmington, Iowa.....	1.3
Van Meter, Iowa .....	5.6	Bondurant, Iowa.....	1.3
Lenora, Iowa.....	5.5	Richland, Iowa .....	1.2
Fayette Co., Iowa .....	4.5	Yates Co., N. Y. ....	1.2
Portsmouth, Iowa .....	4.5	Silver City, Iowa .....	1.1
Iowa.....	4.0	Cedar, Iowa.....	1.1
Ohio .....	3.4	Adel, Iowa.....	1.0
Dexter, Iowa.....	3.2	Green Mt., Iowa.....	.9
Maxwell, Iowa .....	2.8	Monroe, Iowa .....	.8
Davenport, Iowa .....	2.7	Mingo, Iowa .....	.8
Monroe, Iowa .....	2.6	Dallas Center, Iowa.....	.8

Bull. Ia. Agrl. Exp. Sta. 21: 805.

Bull. Ia. Agrl. Exp. Sta. 21: 807.



Collins, Iowa .....	.8	Iowa City, Iowa. ....	.4
Center Point, Iowa .....	.7	Guthrie Center, Iowa.....	.4
Marion Co., Ohio.....	.6	Bonaparte, Iowa.....	.4
Dallas Center, Iowa .....	.5	Medina Co., Ohio.....	.3
Rock Creek, Iowa .....	.5		

Mr. Stewart found that fox tail or pigeon grass (*Setaria viridis* Beauv.) was most commonly found in clover seed, this weed appearing in 50 of the samples examined. The next in abundance was the small fox tail (*Setaria glauca*, Beauv) which appeared 31 times. Now *Setaria glauca* is quite as common in this state as *Setaria viridis* but the reason that it is less abundant in commercial seed is because its seed is larger and hence is removed in cleaning. The common dooryard plantain (*Plantago Rugelii*, Decaisne) was found in 41 samples out of 84. Of the smartweed (*Polygonum Persicaria*, L.) was found more commonly than any other. The seeds of the bind weed, the wild buckwheat, *P. convolvulus*, and the Prince's feather (*Polygonum Pennsylvanicum*, L.) though quite common everywhere in the clover fields of the state was not abundant in the seed for the reason that it is easier removed. Two other grasses, *Panicum glabrum*, Gaudin, and *P. sanguinale*, L., were both found, the former 24 times and the latter 3 times.

Mr. Stewart says the *Panicum sanguinale*, L. the large crab grass ripens its seed too early so that it is not commonly found in clover seed. *Panicum capillare* L. is quite common everywhere in the state in clover meadows and in the table prepared by Mr. Stewart appears 15 times; barnyard grass is also quite common everywhere in the state, and in the same table Mr. Stewart reports it 16 times. The Ox-eye daisy rarely occurs in this state except where it is introduced and in the clover samples examined by Mr. Stewart was found in but a single instance and that from eastern seed.

Prof. Hillman comments on the appearance of clover seed examined by him as follows:

REPORT UPON THE EXAMINATION OF SEVENTY SAMPLES OF  
RED CLOVER SEED

Kind of Seeds Found and Percent of Samples Containing Them

Plantago Rugelii.....	80.0	Chenopodium album.....	55.7
Setaria viridis.....	64.3	Plantago lanceolata.....	52.9
Polygonum Persicaria.....	62.9	Rumex crispus (?).....	52.9



Setaria glauca.....	42.9	Cnicus lanceolatus.....	4.3
Rumex Acetosella.....	42.9	Cuscuta arvensis.....	4.3
Euphorbia nutano.....	41.4	Daucus Caroti .....	4.3
Plantago aristata.....	38.6	Paspalum setaceum.....	4.3
Timothy .....	38.6	Bromus secalinus.....	2.9
Panicum capillare.....	34.3	Monarda sp.....	2.9
Panicum glabrum.....	34.3	Oenothera biennis.....	2.9
Panicum sanguinalie.....	32.9	Rumex salicifolius.....	2.9
Amaranthus albus.....	31.4	Solanum nigrum.....	2.9
Alsike clover.....	24.3	Anagalis arvensis .....	1.4
Amaranthus retroflexus (?)..	22.9	Anthemis arvensis.....	1.4
Brunella vulgaris.....	20.0	Barbarea vulgaris.....	1.4
Setaria verticillata.....	18.6	Brassica nigra.....	1.4
Nepeta Cataria.....	15.7	Camelina sativa.....	1.4
Silene noctiflora.....	15.7	Carex spp.....	1.4
Verbena spp.....	15.7	Cerastium vulgatum .....	1.4
Anthemis Cotula.....	12.9	Cichorium intybus.....	1.4
Plantago major.....	11.4	Eragrostis major.....	1.4
Rumex obtusifolius.....	11.4	Euphorbia sp. ....	1.4
Ambrosia artemisiaefolia....	10.0	Marrubium vulgare.....	1.4
Panicum Crus-galli.....	10.0	Matricaria inodora.....	1.4
Sida spinosa.....	10.0	Meadow Foxtail.....	1.4
White Clover.....	10.0	Medicago lupulina.....	1.4
Polygonum aviculare.....	8.5	Orchard grass.....	1.4
Brassica campestris (?).....	7.1	Oxalis stricta.....	1.4
Lepidium Virginicum.....	7.1	Paspalum laeve.....	1.4
Panicum sp.....	7.1	Potentilla Monspeliensis.....	1.4
Polygonum Hydropiper.....	7.1	Scirpus sp.....	1.4
Lepidium intermedium.....	5.7	Silene sp.....	1.4
Cnicus arvensis.....	4.3	Saponaria vaccaria.....	1.4

Some differences are found in the United States and Canada on the occurrence of dodder seed in the clover. Attention has been called to the occurrence of dodder on clover in the eastern states and has been referred to by the writer. A number of investigators frequently report on the occurrence of dodder seed in clover and have reported its occurrence in Iowa. That dodder is sometimes found, there can be no doubt, since the dodder on clover has been reported here and there in the United States. Mr. Stewart who examined 84 samples of clover did not find the dodder, nor was it found by Mr. D. A. Wallace and R. J. Kinzer who examined quite a number of clover samples from various sections of this state. On the other hand Jones and Orton reported it in five per cent. of the samples examined. In seed examination made in Canada by Prof. Panton, dodder was not reported nor was dodder reported by Prof Harvey of the Maine

Circ. U. S. Dept. Agrl., Div. of Botany 14.

Bull. Ia. Agrl. Exp. Sta. 21: 807.

Rept. Vt. Agrl. Exp. Sta. 1897: 231.

Bull. Ontario Agrl. Coll. 98:



Agricultural Experiment Station. Prof. Hillman reports 1 out of 3 times of 70 samples examined by him.

### DODDER.

During the last few years dodders have made their appearance in different sections of the country upon clover. The following species have been reported upon alfalfa and clover: *Cuscuta epithymum* Muss, occurring on alfalfa and clover; the flax dodder, *Cuscuta Epilinum*, Weihe, occurring on alfalfa and flax; the clover dodder *C. racemosa* var. *Chiliana* upon the clover (introduced species); the warty dodder, *C. indecora*, native to the southern states, is found upon alfalfa and clover; the *C. arvensis*, Beyrich, or field dodder is the most common species east of the Mississippi valley.

One of the earliest references to the occurrence of dodder in this country was made by the writer in response to material received from Mr. Henry Wallace, then editor of the Iowa Homestead. This specimen was sent to the Homestead by Mr. Downing of Halltown, Missouri, with the following letter:

I send sample of a vine that is killing clover, not on my farm alone, but it has quite a start in this section, and all from seed shipped here last spring. I send you some that has dried up, and some green. As soon as it kills the clover (or anything else that it gets hold of) it dies and leaves the ground bare, but the ends of the vine keep on spreading among anything green. There are spots now already dead that are two or three rods across. I hope you will give information as to what it is, and also how to get rid of it.

There can be no doubt that the specimens sent to me were the clover dodder. However it appears from the investigation of Mr. Dewey as well as the investigations of Prof. Hillman that this species is not nearly so common upon the clover in the eastern states as it is upon the alfalfa fields of the west.

The clover dodder has been introduced into the alfalfa fields of the Pacific coast and Rocky Mountain region where it is quite common. Mr. Dewey, who has looked into the matter states that "it is rarely found east of the Missouri river. In the numerous requests that I have received for the identification of weeds in the state of Iowa, this has not been sent to me. No doubt, however, it exists in some places. At any rate through the importation of clover seed from Europe, and alfalfa seed from the west it is

Bull. Nevada Agrl. Exp. Sta. 47: 15.

Dewey, Circ. Div. Bot., U. S. Dept. Agrl. 14.

Ia. Homestead, 1889, Oct. 10.



likely to make an appearance. Farmers should, therefore, be on their guard for this plant. The dodders all belong to the morning glory family (*Convolvulaceae*).

The common bind weed, our cultivated morning glory, moon flower, and sweet potato are close relatives. The family con-

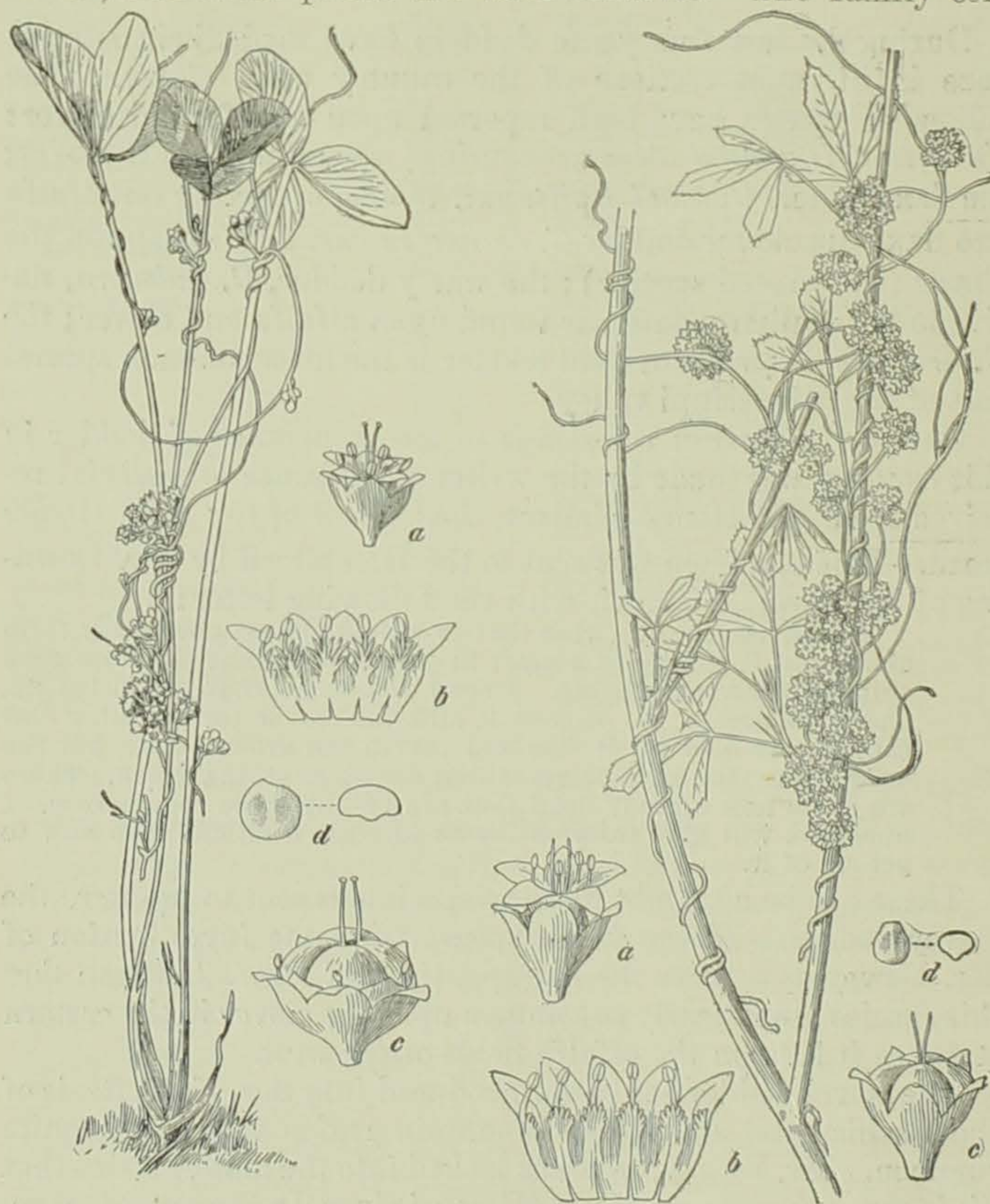


Figure 71. FIELD DODDER, (*Cuscuta arvensis*). Found on clover. a. flower; b. flower spread apart; c. capsule with stamens and styles therein; d. seed. (Dewey Division of Botany U. S. Dept. of Agriculture.)

Figure 72. ALFALFA DODDER, (*Cuscuta epithymum*). a. flower; b. flower spread apart to show stamens and corolla; c. capsule showing styles; d. seed. (Dewey Division of Botany U. S. Dept. of Agriculture.)

tains a good many plants which are troublesome in various parts of the world. The genus *Cuscuta* or dodder contains a good many species, upwards of a hundred having been described by botan-



ists. Of these forty-four are found in America, thirty-nine of which are peculiar to this continent and are found in no other part of the world. Among these American dodders one is frequently found on the high bush blackberry (*Rubus villosus*, Ait). The other species are found on various native plants, such as smartweed, willows and on various composites, such as golden rod, sunflowers, etc. The dodders are leafless excepting the small scales on the stems, herbs of reddish color, with thread-like stems twining around the plants upon which they live. They pierce the bark with small and short rootlets which are called suckers or haustoria. The seeds are small, yet there is stored sufficient nourishment in them to give the embryo a start. The seed germinates in the soil and grows sufficient in length to allow it to come in contact with the plant upon which it lives, when it immediately sends in its suckers, and thus becomes established upon the plant as though it were a part of the host.

The plant continues to spread producing flowers until killed by frost.

Dewey says:

The seeds thus gradually ripened and dropping, retain their germinative power five years or longer under favorable conditions, but in warm moist soils some of the earlier of them will usually germinate during the same season in which they are produced.

The conditions that are the most favorable for the germination are the same as those for the clover plant.

The dodders contain no chlorophyll, the green coloring matter found in leaves, and hence can not assimilate, that is, make starch out of raw material such as ordinary green leaves do, but must derive nourishment entirely from the host upon which they live. Such plants are called parasitic.

*Extermination.*—The first and most important point is to obtain seed that is free from dodder seed. It is best, therefore, to obtain the seed grown in the Mississippi valley and the east. European seed should not under any consideration be purchased. There is likelihood of some danger from the east, some danger from the south, and especially from the west. Clover seed grown in the south of Iowa is hardly suited for our conditions and it is not likely that the Iowa farmer will purchase much of this seed.

Farmers cannot be too emphatically cautioned against sowing dodder-infested seed. The ultimate loss caused by the dodder

Circ. Div. of Bot., Dept. of Agrl. 14: 3. See, also Halsted "Study of Dodders," Rept. Bot. Dept. N. J. Agrl. Exp. Sta. 1901: 451. pl. 12 & 13.



will greatly exceed the cost of cleaning the clover seed, and clean seed should be bought, at any price.

European seed growers find much difficulty in separating dodder from clover seed.

Prof. Chester, of the Delaware station, makes the following remarks concerning this weed in seeds:

The purchaser remarked that it was one of the purest samples of seed he had ever seen, and an examination proved this fact, the proportion of impurities being only four-tenths of one per cent. mainly dirt; but a close examination revealed the presence of *Cuscuta*, or dodder seed, at the rate of 720 to the pound. This seed, when sown at the rate of fifteen pounds to the acre, which is about half that generally sown in Germany, would furnish nearly 11,000 good and vigorous seed to the acre, or enough to give one seed to every two feet, in drills two feet apart. The sowing of this much *Cuscuta* seed upon an acre of land would, at least, be a dangerous procedure, and might result in a total destruction of the crop in the course of two or three years. Every precaution should be taken against the introduction of this parasite in this state (Delaware). In Germany its presence has proved a national calamity, and well nigh forced German farmers to abandon the growth of clover.

The dodder may be exterminated when once established in the following way: First, by the herbicidal treatment. For this purpose a solution of copper sulphate in the following proportions will be found efficacious. A ten per cent solution applied liberally.

In addition the European investigators recommend a strong solution of salt, sulphide of lime, carbolic acid, and sulphide of iron. These solutions will destroy the dodder when found in the vegetative condition, but should seed occur then it will be necessary to take the additional precaution to cut the dodder after the application of the herbicide and burn it. It should be remembered that these solutions will not be effective unless they come in direct contact with the plant.

It is advisable to mow the patch if a small one, rake the material into a pile, allowing it to dry, and then burn. This should be watched carefully for if the seed is formed young dodder plants will make their appearance upon the new growth of clover coming on. So it is best to follow the mowing by hoeing if the spot is a small one, and continuing this for several weeks until all danger of infection is passed. Dewey recommends keeping the soil stirred for about 2 inches, and that shallow cultivation is best since the seeds if buried deeper can not come to the surface and infect the clover plant.

Dodder has sometimes been destroyed by covering with manure



or straw, but this method is hardly practicable or desirable in many instances. Where large areas are infected it is a good idea to turn sheep or the Angora goat in because these animals are among the best weed exterminators. Should a large clover field be affected we would advise in addition that the field be plowed shallow and given clean cultivation for a season. Some hoed crop like potatoes could be utilized for this purpose. It is well further to follow an infected clover field with wheat and oats or maize. But it should be remembered that a number of weedy plants, especially those belonging to the order *Leguminosae* or *Pulse* family are hosts for this same clover dodder.

European investigators find that it will grow spontaneously on nettles, some members of the carrot family, and other plants; that it will grow when forced to do so for a short time on Indian corn and mangolds, but not at all on flax, hemp and sunflower.

The other weeds should, therefore, be looked after carefully in the dodder field.

#### RIB GRASS.—(*Plantago lanceolata*, L.)

Rib grass (*Plantago lanceolata*, L.) also known as ripple grass, ribwort, English plantain, buck horn, plantain, etc., is a somewhat troublesome weed in the clover fields of the eastern states, and has been reported here and there in the state of Iowa in clover fields.

Mr. F. C. Stewart reported this weed several times in the clover examined by him. Mr. Royse has likewise reported this weed in cereals several times from different points in the state and outside of it. The following is a sample of many requests received asking information in regard to this plant.

I found it in the clover field. If I am not mistaken, the Germans in Pennsylvania call it Spitzwedrig; please name it. The seed when ripe is a little longer than clover seed, with which it ripens, and is about the same color. Stock will not eat it.

*Description.*—A perennial or biennial, pubescent, with short erect rootstocks; leaves narrowly oblong lanceolate, somewhat shorter than the scape, three to five ribbed; scapes slender with spikes dense, at first capitate, later becoming cylindrical; bracts and sepals scarious, brownish; calyx of four persistent sepals and glabrous corolla. Two small smooth brownish seeds found in

Pammel. Bull. Ia. Exp. Sta. 13; 72.

Bull. Iowa Agrl. Exp. Sta. 21.

Orange Farmer. Aug. 29, 1891.





Figure 73. RIB GRASS, (*Plantago lanceolata*). A common weed in clover meadows. (Charlotte M. King.)

each vessel. These are hollowed on the face.

*Distribution.*—Native to Europe and common in fields and waste places of New Brunswick to Northwest Territory and British Columbia. In the Rocky Mountain region occasionally. In middle and western states to Iowa and Kansas and southward to Florida.

*Extermination.*—This weed is a persistent perennial in fields and lawns and clover meadows. Nothing but thorough cultiva-



tion will destroy it and in seeding to clover use only pure and clean seed.

OX-EYE DAISY.—(*Chrysanthemum Leucanthemum*, L.)

The European Ox-eye Daisy has long been known as a troublesome weed in the eastern states. Accounts of its pestiferous character are given by Darlington, Halsted and other writers.

*Description*.—A perennial herb with erect stem spatulate, petioled root leaves, those of the stem partially clasping. All the leaves cut or pinnatifid-toothed. The nearly simple stem bears a large, many-flowered head with numerous white rays, scales of the involucre with scarious margins. Both disk and ray flowers produce achenes, the so-called seeds marked with longitudinal lines, pappus absent.

*Distribution*.—Common in fields and meadows of the eastern states and eastern Canada, less common in the middle and western states.

*Extermination*.—The ox-eye daisy is a persistent perennial. In exterminating this weed the same methods must be applied as in the treatment for horse nettle or Canada thistle, although in the western states, or in Iowa at least, the ox-eye daisy is much more easily exterminated than the Canada thistle or horse nettle. We have found from our experience that through cultivation for one or two seasons will remove all traces of the weed.

It occasionally occurs as a troublesome weed in some portions of the west. The writer referred to its common occurrence in western Wisconsin as early as 1887. Since then the writer has observed it not infrequently at such points as Watertown and Milwaukee in the state of Wisconsin. To the south of us it also occurs occasionally. The writer observed it in abundance in parts of Missouri as early as 1887.

The following note published in Colman's Rural World tells of its abundance in that state:

The Ox-Eye Daisy, (*Chrysanthemum Leucanthemum*, L.), is slowly but surely making its way to our fields and meadows. This spring, while botanizing near Webster, Mo., I noticed a considerable quantity of it along the Missouri Pacific railroad tracks. It was rather infrequent between St. Louis and Pilot Knob, not only along the railroads, but also in fields. The argillaceous soil of Missouri is well adapted to it, and too much care and caution can not be taken to eradicate it at once. It is too well known in

Weeds of Southwestern Wisconsin, and Southeastern Minnesota. Rept. of Minn. State. Hort. Soc. 1887. Also as a separate, 13.





Figure 74. OX EYE DAISY (*Crysanthemum Leucanthemum*). Common in the East. (Division of Botany U. S. Dept. of Agriculture).



Eastern United States as one of the worst and most troublesome of the perennial weeds of the meadow.

One naturally asks himself how did the plants get there. It is easy enough for anyone to convince himself of their origin, if he will only notice the great number of weeds left to mature their seeds on the embankments and unoccupied lands, or some of our great trunk lines, and the means the cars offer for the conveyance of seeds and fruits. The general rule is that our European weeds moving westward, make their appearance first along railroads, though of course this is not always the case, and our western plants which move eastward are usually found in similar places.

It was reported in Iowa by the writer in 1891.

Dr. Halsted refers to it without comment as early as 1888.

## WEEDS OF TIMOTHY MEADOWS

The most common weeds found in timothy meadows are the following: the pepper grasses, (*Lepidium apetalum*, Willd, and *L. Virginicum*, L.), occasionally the hedge mustard (*Sisymbrium officinale*, L.), the smaller rag weed (*Ambrosia artemisiaefolia*, L.), sheep sorrel, fox tail or pigeon grass.

The writer annually receives from various sections of the state samples of timothy seed and in every case that has come under the writer's observation the pepper grasses (*Lepidium apetalum* and *L. Virginicum*, L.) occurs in greater or less amount. The amount of these impurities varies from 1 to 4 per cent.

### PEPPER GRASS.—(*Lepidium*.)

*Lepidium* is a genus of considerable size with small flowers and roundish pods, the valves are boat-shaped and keeled, found in both the old and the new worlds in temperate and warmer regions. Our Iowa species are annuals although a few members of the genus are biennials and some perennials. The common garden cress (*Lepidium sativum*, L.) is well known in German communities where it is used as a salad plant. The seeds of two of our species (*Lepidium Virginicum*, L. and *L. apetalum*, Willd), known as pepper grass, are sometimes called "canary grass" and collected as food for birds.

### LARGE PEPPER GRASS.—(*Lepidium Virginicum*, L.)

An erect annual, at first quite simple, later much branched, eight inches to two feet high. Leaves divided entire or with ir-

Bull. Ia. Exp. Sta. 13: 73.

Bull. Dept. Bot. Ia. Agrl. Coll. 1888: 41.





*Lepidium Virginicum*

Figure 75. VIRGINIA PEPPER GRASS (*Lepidium Virginicum*). (Charlotte M. King).



regular, pointed teeth. Flowers small, white. Pod circular or oval with a little notch at the upper end. Seeds light brown, elongated, with a prominent ridge on one side. On the addition of water they become mucilaginous. Cotyledons accumbent.

*Distribution.*—This species is a native of the Mississippi Valley east to New England, but now occurs from Ontario, New England to Florida, west to Wisconsin, Minnesota, Nebraska, Kansas, Missouri and Texas. Dr. Robinson states that it also occurs in the West Indies and is introduced in Europe. In the Iowa State College herbarium it is represented by specimens from Ames and many other points. Large pepper grass is less common than the smaller. It is commonly found along roadsides, in meadows and cultivated grounds.

SMALL PEPPER GRASS.—(*Lepidium apetalum*, Willd.)

Much like the foregoing, an annual eight inches to two feet high, but leaves and pods smaller. Flowers small, greenish. Seeds light brown, elongated, with a prominent ridge on one side. Seeds become mucilaginous when moistened with water. Cotyledons incumbent.

*Distribution.*—A widely distributed species, extending from Nova Scotia to New England, New York, Ontario, Manitoba, to Hudson Bay, Michigan, Wisconsin, Minnesota, Iowa, Nebraska, Colorado, Texas and New Mexico. Dr. Robinson, who has monographed the North American species, states "from New England across the continent and south to Texas where, as in the Northwest, probably indigenous; in the eastern states a wayside weed, appearing as though introduced, North and Central Asia, also advanced in Europe." It is represented by specimens in the Iowa State College Herbarium from many different sections of the state.

It is common in fields and pastures and cultivated grounds throughout Iowa. It is troublesome in meadows and pastures, causing much annoyance in the growing of seeds, especially timothy, frequent cases having been reported to me where it was found as an admixture. The brown color of the seeds attracted the attention of the seedmen.

Prof. P. H. Rolfs says:

Mr. Wright, of Maquoketa, Iowa, sent to the Station a sample of timothy to have the seeds identified. It contained the seed



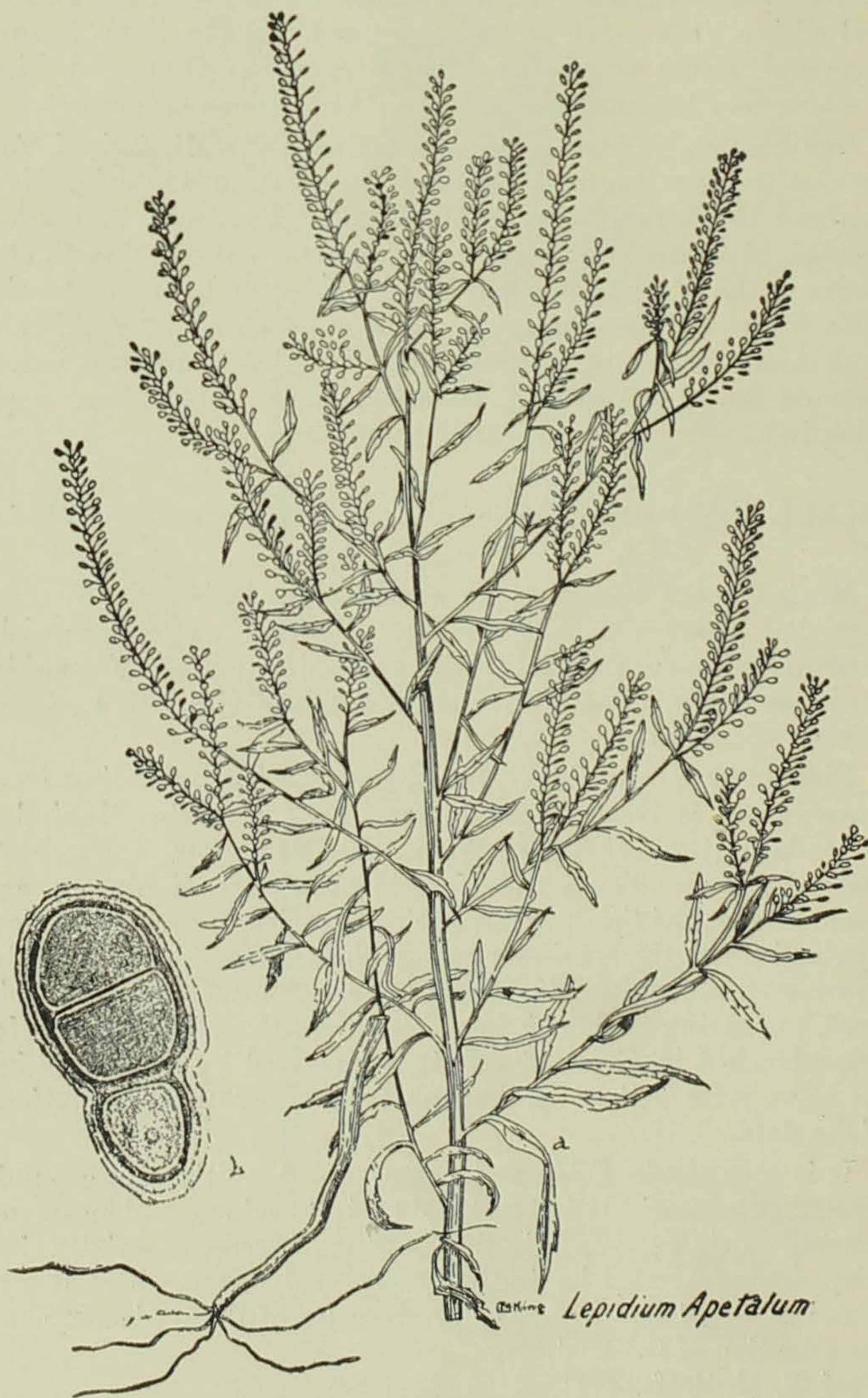


Figure 76. APETALOUS PEPPER GRASS, (*Lepidium apetalum*). (Charlotte M. King.)



of one of the pepper grasses. The color of the pepper grass seed is brownish and is very striking in the timothy seed.

*Extermination.*—The pepper grasses are not difficult to exterminate in cultivated fields since they are annuals. In growing of timothy seed it is important above all to have a field as clean as possible from weeds. Timothy should therefore be sown in a field that has been under thorough and clean cultivation for several years and clean seed should only be used. In this way the pepper grass can largely be prevented.

#### FLEABANES.—(*Erigeron*.)

In many parts of Iowa two of the fleabanes are commonly found in our timothy meadows, one, the annual fleabane (*Erig-*



Figure 77. FLEABANE, (*Erigeron annuus*). Common in fields. (Charlotte M. King).

*eron annuus*, Pers.) and the other the daisy fleabane (*E. strigosus*, Muhl.)

*Description.*—*Erigeron annuus*, Pers.—A sparingly pubescent annual from three to five feet high; leaves thin, coarsely and



sharply toothed, the lower one ovate, or ovate lanceolate acute and entire on both ends; heads corymbed; rays white tinged with purple.

*Description.*—*Erigeron strigosus*, Muhl.—This resembles the preceding species but the stem and leaves are somewhat more hirsute and hairy, roughish, entire or nearly so, the upper lanceolate the lowest oblong or spatulate; flowers white and smaller than the preceding species.

*Distribution.*—From Nova Scotia to Florida west to Louisiana and Texas to Northwest Territory.

*Extermination.*—Both of these weeds are easily exterminated by thorough cultivation. They are seldom troublesome outside of meadows though in some parts of Iowa the meadows and pastures are white with the flowers of these species.

#### PRAIRIE THISTLE.—(*Cnicus discolor*, Muhl.)

The prairie thistle is common in many parts of Iowa not only in pastures, but also in meadows and occasionally in corn fields.

*Description.*—Tall, branching, leafy biennial, five to seven feet high, with heads larger than Canada thistle, stem striate, slightly hirsute; leaves radical, twelve to fourteen inches long, deeply pinnatifid, the divisions frequently divided, prickly toothed, the upper surface smoothish, and the lower white, woolly single heads terminating the branches, with purple flowers; heads one and one-half inches high; bracts of the globose involucre somewhat suppressed, slightly arachnoid, lower bracts ovate with a broad base and a weak prickly recurved bristle, slight dorsal gland, inner linear lanceolate with a nearly colorless entire appendage; flowers purple, tube of the corolla nearly eleven to twelve lines long, lobes of the corolla terminating in clavate tips, anther tips acute, filaments pubescent; bristles of pappus plumose; achenium twenty-two lines long, smooth, upper part yellow.

*Distribution.*—Common in many portions of Iowa. Marshall, Johnson, Winnebago, Lee, Winneshiek, Allamakee, Green and Emmet counties, Keokuk, Muscatine, Ames, Cedar Rapids, Carroll, Boone, Des Moines, Polk City, Steamboat Rock, Mason City, Belle Plaine and Iowa City.

*General Distribution.*—In fields and along roadsides from Quebec, Ontario south through New England, New York and



Georgia, west to Missouri, Nebraska and South Dakota.

*Extermination.*—This field thistle should be treated like all other biennials. The flattened masses in the spring should be cut off below the ground, none of the plants must be allowed to go to seed.

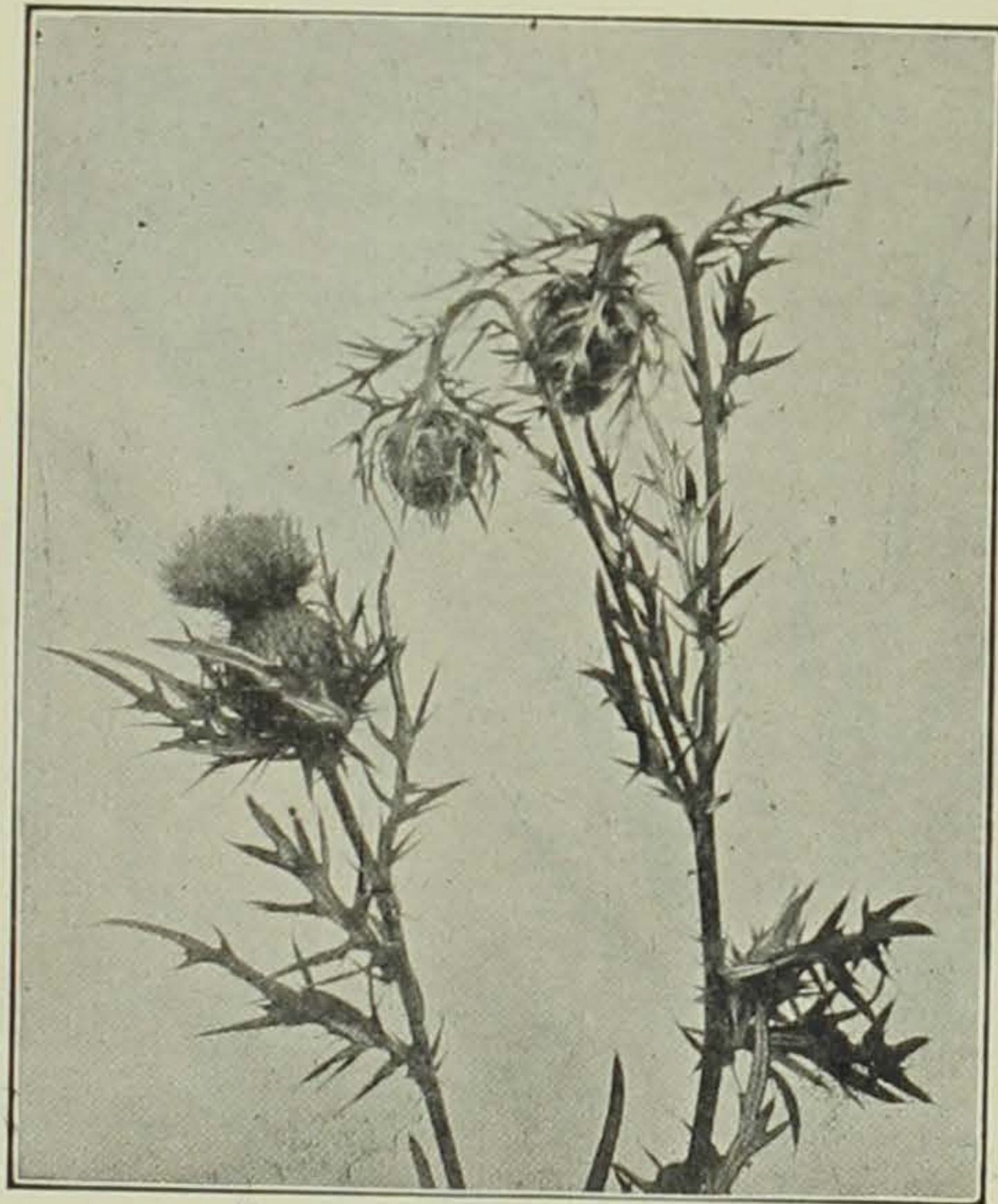


Figure 78. PRAIRIE THISTLE, (*Cnicus discolor*.)

WOOLLY THISTLE.—(*Cnicus canescens*, Pammel.)

We have received numerous inquiries in regard to this weed from western and northwestern Iowa.

*Description.*—Branching perennial two to four feet high, woolly throughout, branches bearing single medium-sized heads, stem angled, white woolly; leaves, radical eight inches to a foot long, the divisions usually two-lobed, prominently ribbed, ending in stout spines; stem leaves, except the lower, one to four inches long, pinnatifid, the upper sessile, slightly roughened, and a slight cottony down, the lower white woolly; heads one and one-half to two inches high, bracts of the involucre somewhat arachnoid, lower scales with a broad base, glutinous ridge, and ending



in a minutely serrated spine, inner scales long attenuated, tips straw-colored; flowers purple.

*Distribution.*—This species is distributed from Mason City southwestern Minnesota, west to the Rocky mountains. Collected by Chas. A. Geyer in 1839 and described by Nuttall. The

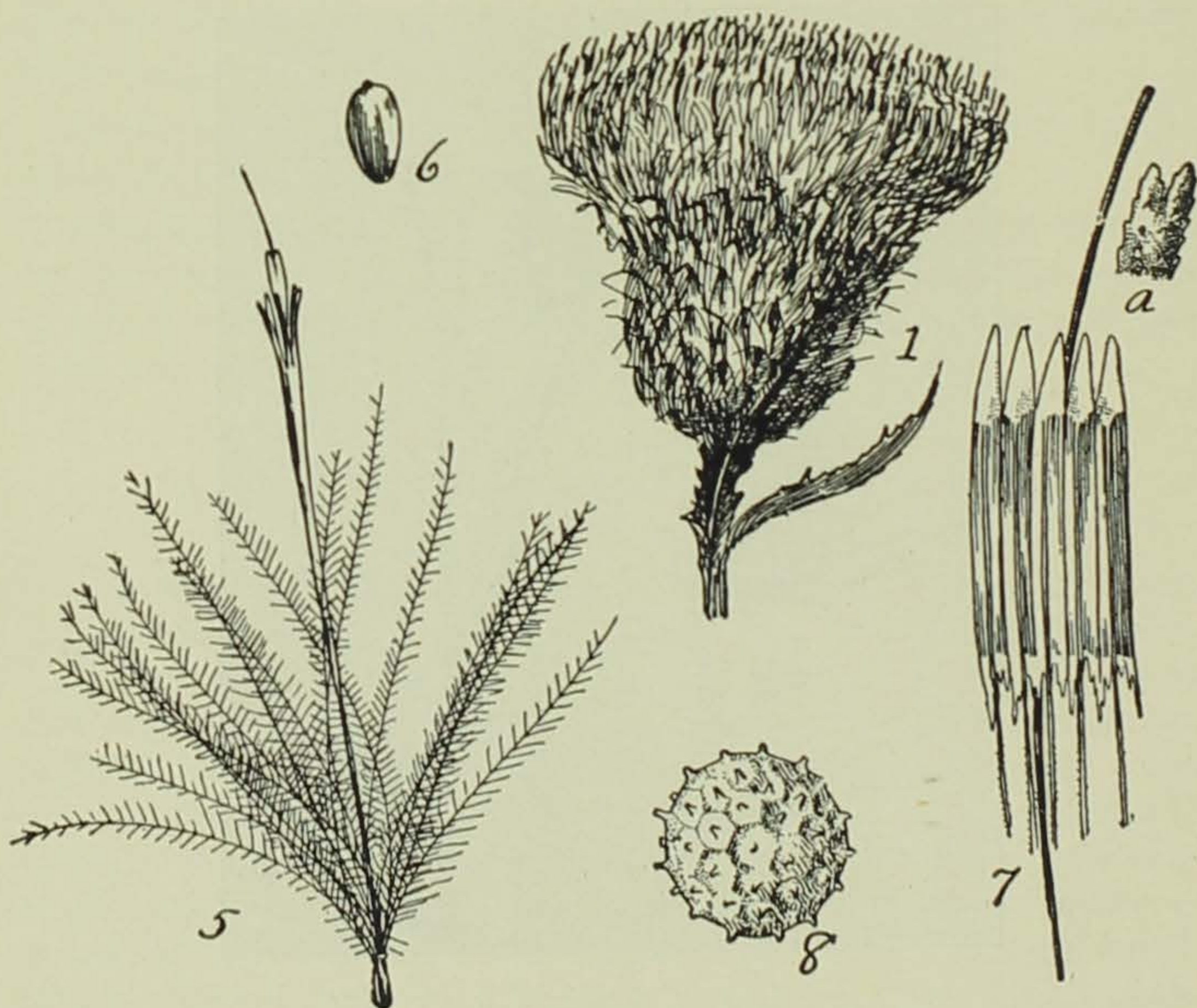


Figure 79. WOOLLY THISTLE, (*Cnicus canescens*.) Common in north-western Iowa. (Charlotte M. King.)

writer has seen it very abundant in both Wyoming and Colorado.

This species also occurs in Emmett, Dickinson, Sioux, Plymouth, Woodbury, Cerro Gordo, Worth, Kossuth, Ida and Carroll counties in Iowa.

*Extermination.*—Correspondents sending this weed frequently refer to it as Canada thistle. It occurs not only in pastures and meadows, but also in corn and grain fields. It grows in patches like the Canada thistle. These patches increase in size from year to year. It was described as a doubtful perennial by early botanical writers and so far as I have been able to determine it is a perennial. It may be exterminated by thorough cultivation, plowing well and then follow with the cultivator.





ROOT OF WOOLLY THISTLE, (*Cnicus canescens*). (Charlotte M. King.)

## SOME WEEDS OF PASTURES.

In another connection the writer discussed some of the more important weeds of the meadows and pastures of Iowa.

Both of these publications had but a limited distribution. In order that our farmers may become more familiar with the more important weeds of the meadow, we shall describe here briefly some of the common weeds found in our meadows and pastures.

### SQUIRRELTAIL GRASS.—(*Hordium jubatum*, L.).

Perhaps no weed has given so much trouble to the Iowa farmer as the squirrel-tail grass or wild barley (*Hordeum jubatum*, L.) which was described in one of our earlier bulletins.

Bull. Ia. Agrl. Exp. Sta. 54: 302.

Bull. Ia. Geol. Survey 1: 448.

Bull. Ia. Agr. Exp. Sta. 30: 302.



*Description.*—An annual or winter annual from six inches to two feet high producing fibrous roots. It forms solid and compact bunches. Leaves not unlike those of blue grass, but paler in color, from two to four inches in length, margins scabrous. Flowers in a dense spike from two to four inches long, pale green or purplish in color. The spike consists of a number of one-flowered spikelets, three occurring at each joint, only one is perfect (bearing stamens and pistil). The two other spikelets are awl-shaped and rudimentary; these are borne on short stalks. One of these sterile spikelets occurs on each side of the perfect flower which bears a long awn. At each joint will be found six empty long-awned glumes spreading at maturity. These give to the plant the bristly appearance at maturity. When mature the spike breaks up into joints consisting of the rudimentary spikelets and a perfect flower, so that each joint has one "seed." The number of "seeds" in a spike varies from thirty-five to sixty. A single cluster of plants may therefore produce from three hundred to two thousand mature "seeds." The plant has a wonderful capacity for "stooling." From a single plant as many as forty spikes may be produced, and the number no doubt often exceeds this.

*Germination of seed.*—During germination the palea and flowering glume remain in situ. The embryo occupies only a small portion of the "seed." The scutellum (cotyledon) lies close to and on the side of the endosperm. The plumule pushes out from the upper while the caudicle arises from the lower end. The latter bears the rootlets that anchor the plant to the soil and enables it to take up water and mineral elements.

*Dissemination.*—The weed is disseminated chiefly by the wind, but may also be disseminated by animals. This is spoken of more in detail in another connection.

*Distribution.*—I cannot in this connection give in detail the distribution of the weed in the various states and territories, although most interesting to the botanist, I may say that this plant was made known to science by Linnaeus, from specimens found in Canada. Dr. Asa Gray, in his *Manual of Botany of Northern United States* in 1856 gives its distribution as marshes and moist sands of the sea shore and the northern lakes. In 1868 its distribution had not extended, but Watson and Coulter who revised the manual (1890) add to the above "and westward." Its present distribution is as follows: from Nova Scotia to New Bruns-



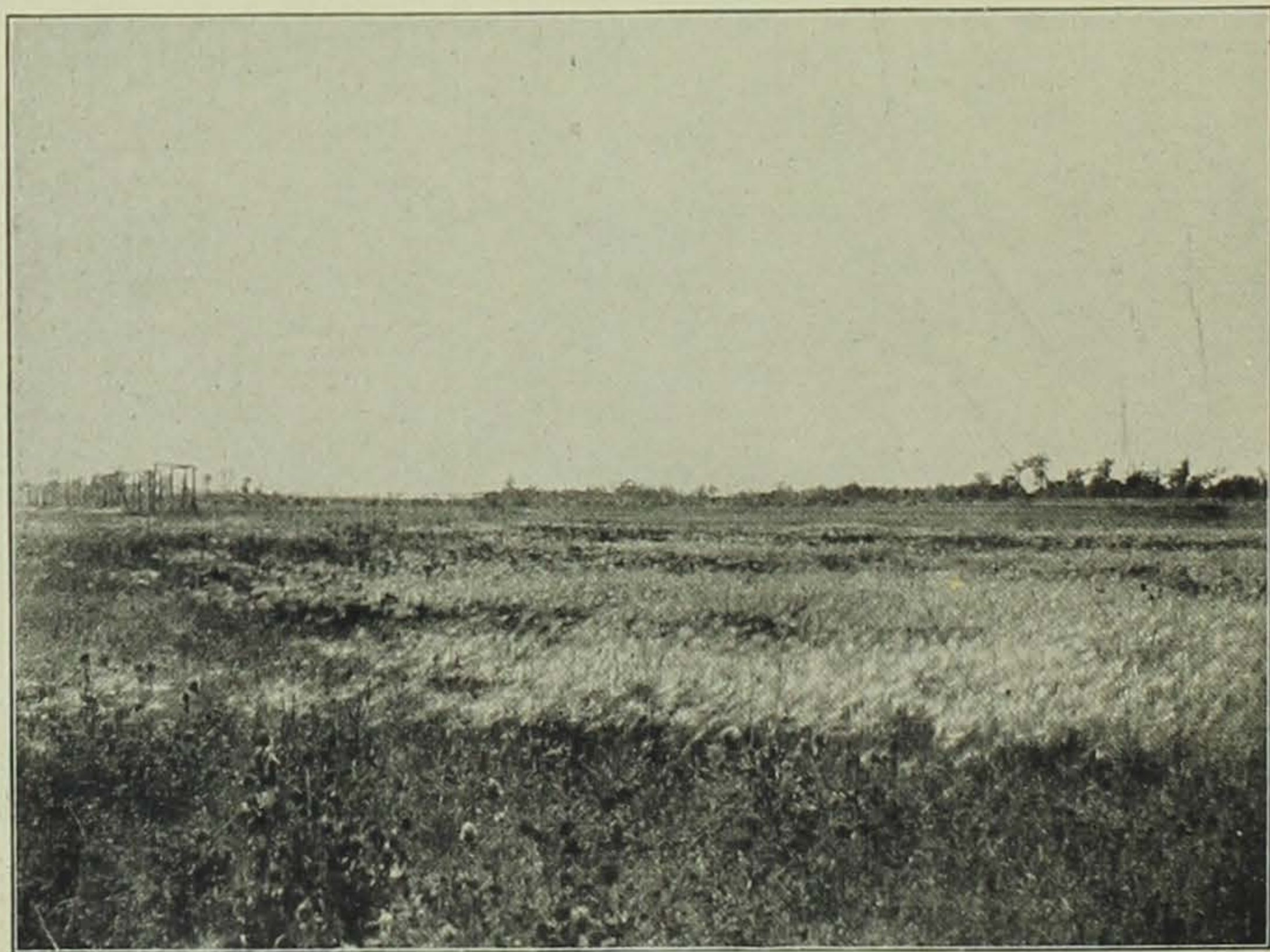


Figure 80. SQUIRRELTAIL GRASS or WILDBARLEY (*Hordeum jubatum*).  
A single cluster of plants. (Photo by Charlotte M. King)



wick, along the Atlantic coast Maine to Maryland, and westward to the region of the great lakes, Minnesota, Saskatchewan and the McKenzie river, the Dakotas, Iowa, Nebraska and the Rocky Mountain region, south to Texas, California and southern Mexico. It is also reported from Europe and Siberia.

From this general account it is very evident that this weed in North America was chiefly distributed in the Rocky Mountain region occurring in saline soils of the plains, the great lakes and along the sea coast extending far northward. Its extension eastward and westward has taken place in more recent times. It does not occur as far as I can learn, in the southeastern states. It is



A meadow with Squirrel Tail Grass. (Charlotte M. King.)

spreading in Missouri, and has some foothold in Arkansas. It is not reported from Tennessee by Prof. Lamson-Scribner in his monograph of Tennessee grasses. In Wisconsin it has spread north, south and west, and before many years will become general in the state.

Its distribution as given above shows that it is adapted to a wide range of climatic conditions. Not only does it occur in a climate where there is not sufficient moisture to produce ordinary



crops, but it also occurs in a climate in which there is more than enough moisture to produce the most luxuriant of crops.

Nearly a quarter of a century ago this weed was mentioned as occurring near Ames by Prof. Bessey.. He says, "Found along railroads, perhaps introduced." The locality given is Ames, but it undoubtedly occurred in other parts of the state but not abundant or the fact would have been noted. In 1876 Dr. J. C. Arthur listed the plant from Iowa without locality. Prof. Halsted refers to the weed as common but not excluding valuable plants. He considered it an introduced plant. One other botanist, Prof. A. S. Hitchcock listed the plant from Ames, and remarks: "Waste places: common." The plant was certainly abundant about Ames in 1889. It appears from evidence obtained from various correspondents in this state that the plant has been found in some sections as long as 48 years at Cedar Falls, 27 years at Mount Pleasant, Ft. Dodge 43 years, Rossville 38 years.

*Spread of the weed in Iowa.*—We are without exact data of its early appearance in the state, though it was probably a native in portions of western and northwestern Iowa, especially where the soil was somewhat broken up. The replies received from circular letters it would seem to indicate that this grass had been known in part of Iowa for forty years, but it is only during the last fifteen years that it has made much headway. Though possibly native, it is more than probable that this weedy grass has come into our state from the west as well as the east. It has become so thoroughly at home in many parts of Iowa, that no one will be able to say except for the records we have, but that it has always been indigenous.

*The weedy nature of the plant.*—This grass has exerted itself with great force in parts of the west where irrigation is practiced. Originally a plant that occurred in more or less saline soil, hence its abundance around the great lakes where many saline plants occur, and in the west where plants like the following appear as salt grass, (*Distichlis maritima*, Raf), *Scripus maritimus*, L., *Salicornia herbacea*, L., and *Atriplex patula*, L.

Contributions to the flora of Iowa. Fourth Biennial Report of Trustees of the Ia. Agrl. Col. and Farm, Dec. 1871: (1872) 129.

Contr. to the flora of Iowa, Charles City 36: 1876.

Bull. from Bot. Dept. Ia. Agrl. Coll. 1888: 47.

Catalogue of the Anthophyta and Poteridophyta of Ames, Iowa. 1891: 530.



At least twelve years ago I noted its habitat in low swamps and swales, that used to dry up in late summer about Madison, Wis. In Iowa, at least it is no longer confined to low grounds and swamps but occurs on the highest land, highways, in streets and is also a most troublesome weed in pastures. I noted it as abundant early in July in every county and town between Ames and Omaha, the dry spikes showing conspicuously since cattle avoided it from the middle of June and occasionally earlier. Pastures appeared to be made up of little else than this weedy grass. The purple spikes were conspicuous from a distance. This grass has not been considered so troublesome in the meadow because it may be cut, however, some years it causes much annoyance because of the poor stands of timothy and blue grass in many cases. This grass matures so early that it will more than likely cause some trouble in both blue grass and timothy meadows.

Numerous agricultural writers mention its pernicious character.

In Colorado Prof. Crandall says:

It is one of our worst weeds, spreading rapidly in lands wet from seepage and also troublesome in cultivated grounds. It is especially bad in meadows; its presence greatly lessens the value of hay on account of the injurious effect upon stock of its long rough awns.

In Wyoming Prof. Nelson says:

Wet lake and sea shore meadows and cold, wet alkaline plains are rarely free from it. This will in part explain its rapid spread in this and neighboring states, for with the extension of our irrigation systems the above conditions are being multiplied and the means for the rapid distribution of the seed are furnished. The land immediately adjoining irrigation ditches and low places, wet from seepage, as well as land flooded early in the season or on which the water has been allowed to stand throughout the winter and spring are particularly liable to be infested.

The writer has given some attention to this weed in the same state, where it is considered one of the most pernicious of all the weeds in the meadow, especially where affected with a light alkali. It crowds out the better and more valuable grasses. This is likewise true for the irrigation ditches of Utah.

In Nevada Prof. Hillman says:

This is considered the worst weed in Nevada. It spreads easily and rapidly. Its presence in the meadow depreciates the feeding value of hay as the barbed awns lodge in the mouths and throats of animals and produce angry sores.

In California, according to Prof. Brewer, over pasturing has killed the nutritious bunch grass and this weed has come in.

In our own state many persons have commented upon the de-



struction of the pasture by this weed.

Ex-Governor Packard says:

The grass has been in small patches about the sloughs for a year or two but this year it is spreading over the pastures, and I am told that it has covered some of them largely, south and west of here. It is just showing over my large pasture on the Iowa river bottom.

*Injury to Stock.*—Mr. Donelsen, of Boone county, thinks it is the worst weed for pastures in the state. Not only is this grass crowding out the more valuable species, but it is often injurious to cattle. This fact has been commented on by Profs. Nelson, Crandall and Hillman, and in our own state Dr. S. H. Johnson of Carroll, makes the following statement in the Carroll Herald:

Editor Herald: In your issue of the 21st I notice an article from the pen of the Hon. James Wilson, pertaining to *Hordeum jubatum*, or Squirrel-tail Grass, which has spread so fast over the country in the last two years.

This grass when found in hay and allowed to ripen, if in any quantity, is very injurious to horses' mouths. The small awns seem to work in and cause deep ulcerating sores which form under the tongue and lips. The writer has seen a large number affected, and made a careful examination and found them deep in the flesh, where they had remained for three months or more. Have seen lips eaten completely through and tongues eaten almost off by the grass. As to cattle, I have seen some affected, but not to any extent, because the mucous membranes are much thicker. If the grass can be eradicated early, the sooner the better.

*Extermination.*—This weed is an annual or a winter annual, but Mr. R. T. Kingman of Carroll, thinks it is perennial, and that it comes up from a well knit sod. The fact is the weed appears abundantly in the fall, or when cut off comes up from the lower joints. It must be kept down. In well cultivated fields there is very little trouble, as the cultivation of garden and field crops prevents growth. To prevent its seeding in the meadow, grass should be cut early, but the seed, as stated before, matures earlier than blue grass and much earlier than timothy. Grass must be cut young; much can be done in this way. In pastures it is a good plan to mow as soon as the heads come out. This will not injure the meadow, and blue grass will have a chance to grow. It will not be necessary to plow up the meadow if the grass is cut in this way for a few years, but farmers and road overseers should not neglect the roadsides and out of the way places where this weed grows so luxuriantly, and where it may produce seed enough to sow neighboring farms. If it becomes very thick in

Fourteenth An. Meet. Soc. for the Prom. Agri. Sci. 1893: 43.

Carroll Herald, June 28, 1895.



the pasture, the pasture should be cultivated and then sown to clover, gradually letting blue grass work its way in. It may be said that blue grass pastures will not suffer seriously from this weed, but all who have seen pastures in June must admit that it destroys much of the value of the pasture.

*Value for forage.*—Wild barley has but little value as a forage plant when it is in the flowering stage and later, but during the fall and early spring when the plants are small they are eaten and afford considerable pasturage. It comes up so abundantly from the old cut off stems that it has the appearance of being a perennial. An abundant leafy growth in the fall covers the ground in many cases, and in this condition is eaten by stock of all kinds. In considering its nutritive value, one must consider its noxious qualities, and these so outweigh its good qualities that it should be kept down. Dr. J. B. Weems has made some chemical analyses of the plant in various stages of growth. His account should be consulted.

Dr. Weems and Mr. W. H. Heileman comment as follows on the wild barley:

If we examine the analysis of the dry matter of the samples analysed it is seen that the amount of fat or ether extract decreases as the grass matures, and that the young sample contained nearly three times the amount of albuminoids as the mature sample. The crude fiber also increases as the plant matures, while the ash decreases, and on the other hand the nitrogen free extract increases. A comparison may be made with the standard plants which are in general use such as timothy, red clover and Kentucky blue grass, the average analysis of which may be stated as follows, based on the dry matter:

	Fats	Crude Protein.	Crude Fiber.	Nitro-gen—free extract.	Ash.
Timothy .....	2.9	6.8	33.50	51.7	5.1
Red Clover.....	4.9	13.5	31.3	43.0	7.3
Kentucky Blue Grass..	3.7	11.8	26.2	50.3	8.0
Sample I (very young)	5.45	24.91	23.07	33.46	13.11
Sample II (older).....	4.14	15.07	28.61	39.50	12.68
Sample III (matured).	3.25	9.04	34.08	42.06	11.30

From the above table it is seen that the chemical analysis of squirrel-tail grass indicates that when it is young it will compare favorably with timothy, red clover, and blue grass.

## DOCKS.

There are several species of dock common in our meadows. Several of them are quite troublesome as weeds at times. Among the docks we may mention the curled dock *Rumex crispus*, *R.*





Figure 82. CURLED DOCK. (*Rumex crispus*). A common European weed. (Division of Bot. U. S. Dept. of Agriculture).



*salicifolius*, and *R. altissimus*.

*Description.*—*Rumex crispus* is a smooth perennial from three to four feet high, leaves with strongly wavy and curled margins, lanceolate and acute. In the lower leaves the bases somewhat truncate or inclined to be heart-shaped. The flowers are collected in dense whorls, extended or prolonged into racemes, entirely leafless above, but below with small leaves. The flower consists of six sepals, the outer herbaceous, leaflike, the three inner larger and somewhat curled, and after flowering forming the valves of the fruit. These surround the three angled fruit (achene) all the valves bearing a grain. The *R. altissimus*, Wood, which is allied to the *R. crispus*, L., occurs in low ground, and is from two to six feet high. The leaves are longer, oblong, lanceolate, acute, pale, thickish, but not with wavy curled margins as in *R. crispus*, L. The racemes are long, spike-like panicle, nearly leafless. One of the valves has a conspicuous grain.

*Distribution.*—Both of these species are common in the state.

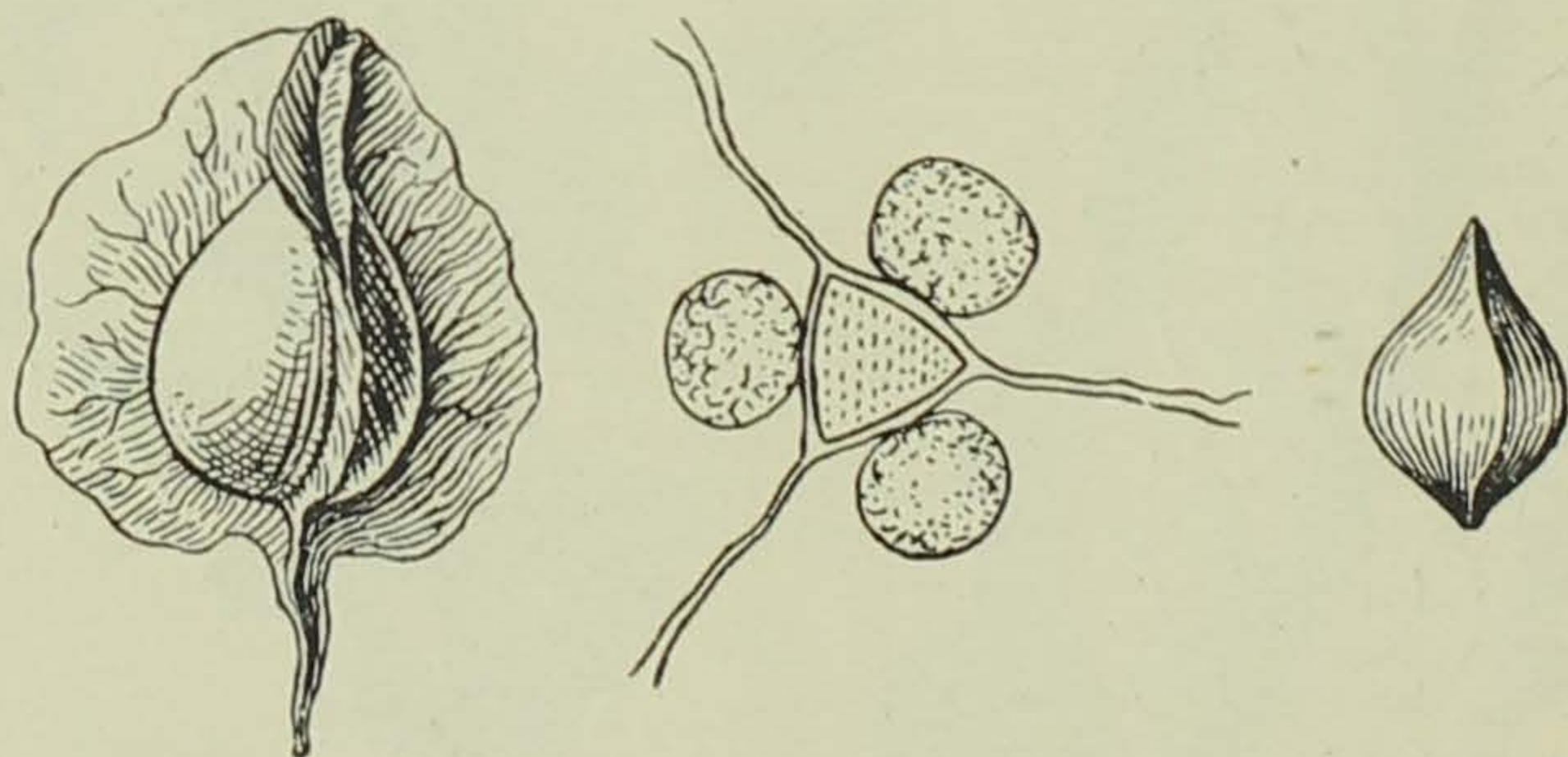


Figure 83. FRUIT OF COMMON DOCK. 2. Sectional view of wings and fruit. 3. Fruit. (Beal).

The curled dock is native to Europe and has been naturalized for a considerable length of time. The pale dock occurs in moist ground from New England to New Jersey, Minnesota and Kansas and west nearly to the Rocky mountains.

*Extermination.*—Both of the species mentioned here are perennial. One of the most efficient means of destroying this weed is to root it out by the hand and this is done very readily in the spring when the soil is wet by taking hold of the plant just at the surface of the ground, giving the root a slight twist and at the same time an upward pull, and the root will readily come



from the soil. Where it is common, however, it is sometimes plowed or a spud is used. This method is not, however, so effective as the pulling method.

SHEEP SORREL.—(*Rumex Acetosella*, L.)

Sheep sorrel is closely allied to docks. It is quite prevalent in many sections of this state.

*Description*.—A low smooth annual or perennial, usually the latter, growing from six to twelve inches high; producing an erect stem, with horizontal, creeping, woody rootstock or rhizome; petioled, narrowly hastate, narrow, lanceolate leaves, the upper linear; flowers on jointed pedicels; dioecious small in a terminal naked panicle; small green calyx; exserted stamens; the valves (inner calyx lobe) not enlarging in fruit

*Distribution*.—The plant is abundant everywhere in northern United States, where it was early introduced from Europe. Some writers consider that it is indigenous. There is a widely prevalent opinion that the soil in which it occurs is sour; *i. e.*, that the soil lacks lime, and that the addition of lime will exterminate the weed. This is, however, far from being correct. It is quite as common upon calcareous soils of western Wisconsin and eastern Minnesota as it is upon the dry sterile hills of Massachusetts and the hillsides, sterile knolls and prairies of Iowa. While it is true that some of the places in which it occurs in the east are lacking in lime, it is certain that our Iowa soil and the Wisconsin soil contain considerable quantities of calcareous matters. So that this theory is hardly sufficient to account for its abundance. Besides the plant contains considerable quantities of calcic oxalate crystals which probably gives the plant its sour taste.

*Extermination*.—The plant succumbs quite readily to cultivation, and where the fields are thoroughly cultivated with hoed crops, it is seldom troublesome more than one season. In fact the vast majority of plants may be killed by cultivating the soil once or twice. The rootstocks though produced abundantly seem not to be able to stand drying.

This seems to be also the experience of Dr. Halsted who says:

This pest can be subdued by keeping the infested land under the plow for a short time.





Figure 84. SHEEP SORREL (*Rumex acetosella*). A common weed in pastures and meadows, from Europe. (Division of Bot. U. S. Dept. of Agriculture).





Figure 85. BURDOCK (*Arctium Lappa*). A common biennial weed of waste places, gardens and pastures. (Division of Bot. U. S. Dept. of Agriculture.)



BURDOCK.—(*Arctium Lappa*, L.)

It is one of the common weeds of Europe and America. Indigenous to Europe, but has become naturalized in the eastern United States, and to find it in yards is an indication of carelessness on the part of the occupant.

*Description*.—A coarse, branched biennial from a foot to three feet high; hairy; leaves large, roundish or heart shaped, thin, obtuse, entire or dentate, floccose tomentose beneath. Petioles deeply furrowed, heads of purplish or whitish flowers, clustered or somewhat corybose. The involucre surrounding the flowers (heads) are lengthened into hooked tips, glabrous or slightly cottony.

Where burdocks are allowed to grow freely the fruit clings to the fleece of animals, often forming large balls which may be found on the tails of cattle and horses. When they are common where sheep pasture the burdocks work into the wool which soon becomes of little value.

The plant is enormously productive. It begins to bear fruit the second year and continues to flower till frost. In fact, it is capable of standing considerable frost. The achenes (seeds) are small, oblong, flattened affairs, having a short pappus ("hairs") which soon falls off. There are several well-marked varieties which differ mainly in size of the leaves and heads.

*Distribution*.—Common from New Brunswick westward in the Canadian provinces in Canada, southward to Alabama, Mississippi valley in general, Rocky mountain region, and Utah.

*Extermination*.—Burdock is easily destroyed. Since it is a biennial cut off below the crown during the summer. If it comes up again, cut off once more, or as often as may be necessary. Dr. Vasey says:

It may also be killed by being mowed when the seed has fully formed and the tops burned.

Prof. Shaw says:

Farmers who go over their fields twice a year with the spade will soon have no burdock.

Prof. Goff says:

During the first year of growth the plant is readily destroyed by pulling out by the roots when the ground is very wet.

The important thing is not to allow it to go to seed; it will then die if left to itself. But we can always expect an abundance of

Rept. U. S. Dept. of Agrl. 1886: 86.

Bull. Wis. Agrl. Exp. Sta. 39: 12.



the weeds as long as it is allowed to grow in waste places. Then add to this its excellent means of dispersion and no wonder it is constantly coming up.

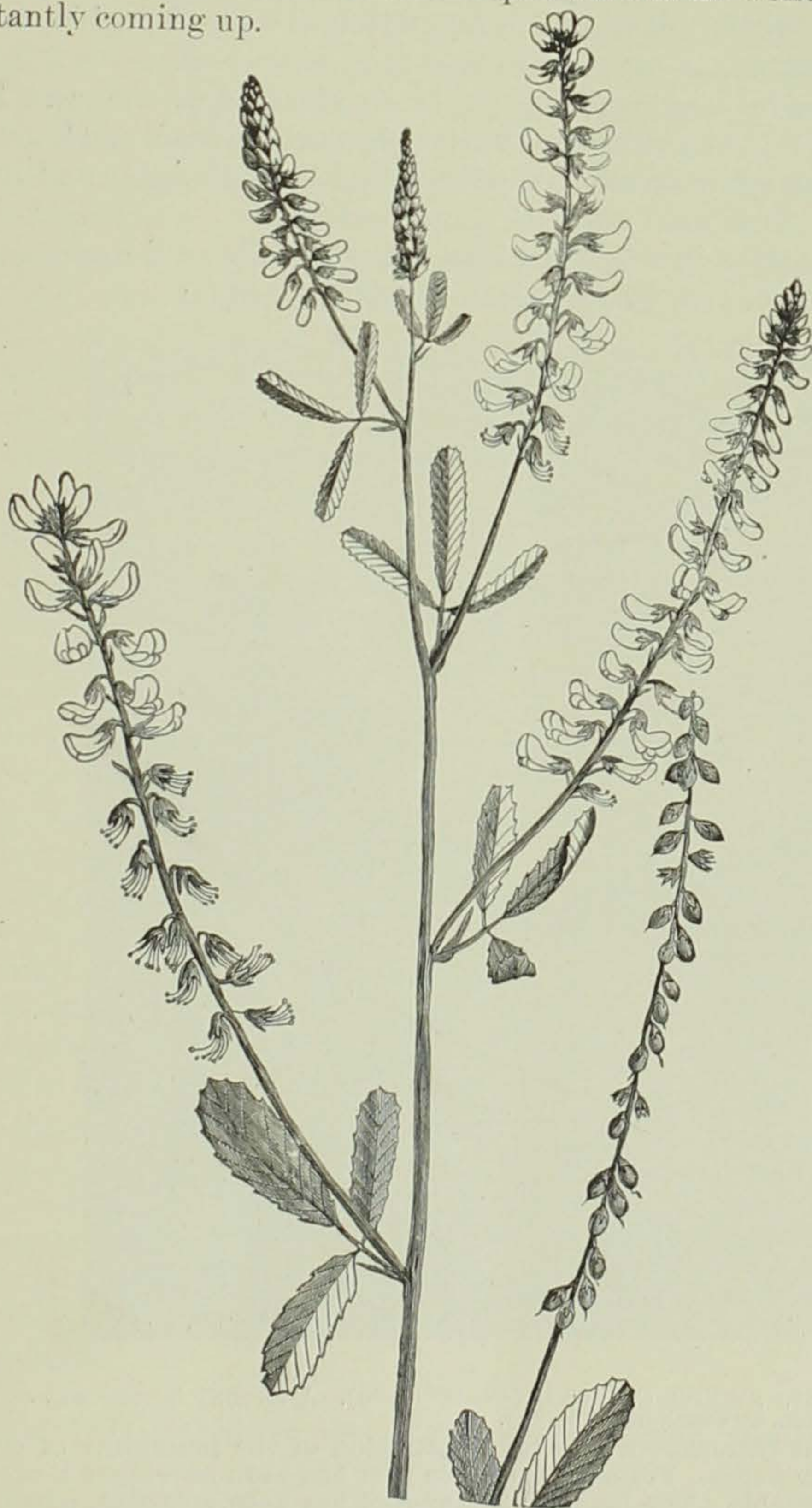


Figure 86. SWEET-CLVER (*Melilotus alba*). (Division of Bot., U. S. Dept. of Agriculture).



*Uses.*—The old name of this plant was *Lappa officinalis*, indicating its use at one time in medicine. It is not used to any extent now, although it has some reputation as a blood purifier and a cure for rheumatism. In England the young shoots are stripped of their leaves and sometimes used in place of asparagus. In Japan the root of a cultivated variety is used for food, and known as Gabo, which is from three to four inches in diameter and two feet long. It is used much as we use salsify.

Prof. Georgeson in a series of interesting articles on the economic plants of Japan, in *American Gardening*, says:

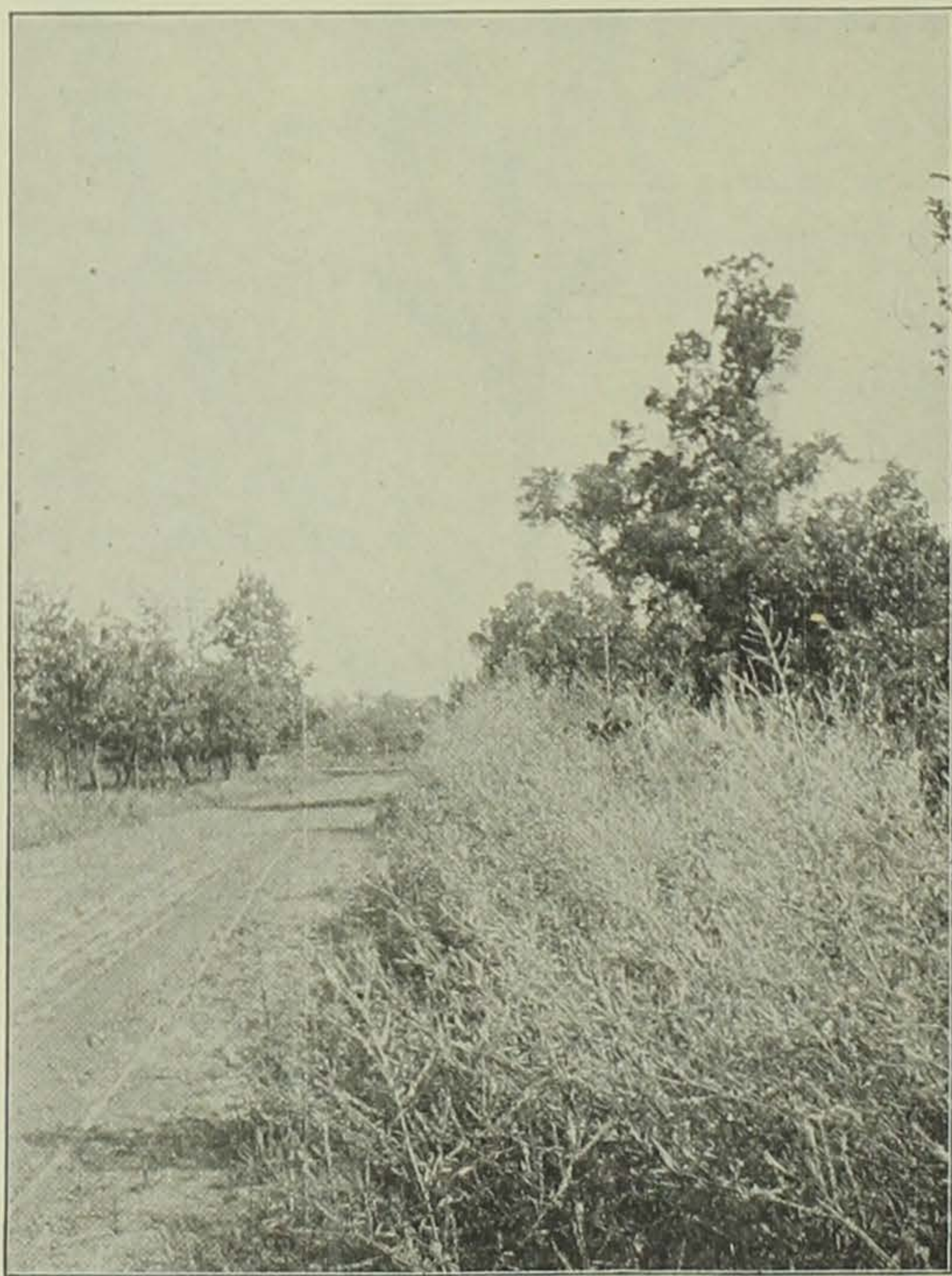


Figure 87. SWEET CLOVER (*Melilotus Alba*). A recently introduced weed of fields. (Photo. by Charlotte M. King).

It furnishes a striking illustration of the mutability of common weeds. From an intrusive pest has been developed a useful vegetable. The long tender tap-root has been enlarged, rendered fleshy and tender, and in a general way it partakes of the qualities, and is even more generally used than parsnips with us.



SWEET CLOVER.—(*Melilotus alba*, Lam.)

Sweet clover is one of the most common weeds in some pastures of the state. The yellow sweet clover (*Melilotus officinalis*) is found here and there in the state but is not nearly so abundant as the white sweet clover. In the eastern states a third species (*Melilotus indica*) has been introduced on ballast. This species also occurs on the Pacific coast where it is extremely common.

*Description*.—An erect annual or biennial from two to four feet high; rather distant, compound leaves, leaflets obovate, oblong, obtuse, serrate, narrowed at the base, truncate, emarginate or rounded at the apex. Flowers with white petals, small, fragrant. Pod ovoid, reticulated and smooth.

*Distribution*.—Abundant in waste places in the eastern and Atlantic states, also in the southern states and throughout the Mississippi valley, the Rocky mountain region and the Pacific coast.

*Uses*.—The Melilots are near relatives of the clover, but are probably not nearly so valuable as forage plants. In the south, however, the white melilot (*Melilotus alba*) is mentioned as being a forage plant of some value. In the north this species is principally recognized as a weed, occurring along roadsides and in waste places. In the south, however it is valuable for reclaiming waste land, as it grows not only on rich soil, but thrives on the poorest kind of land. Prof. Tracy commends it as a soil renovator as well as a honey plant. The sweet clovers are valuable honey plants. They produce an abundance of flowers, which contain a great deal of nectar. Besides this, these plants also contain a sweet ethereal oil, coumarin; in fact, the odor of the melilots on flowers is due to the coumarin. The same substance is also found in new mown hay of other forage plants.

*Extermination*.—The only way to exterminate this weed is to prevent seed formation. This may be done by cutting the plants off underneath the ground. In fact the young plants are easily exterminated in this way. The plants occur in the meadows and pastures, coming largely from the weeds left growing along the roadsides. Road overseers should see that these chance plants are removed.

BULL THISTLE.—(*Cnicus lanceolatus*, Willd.)

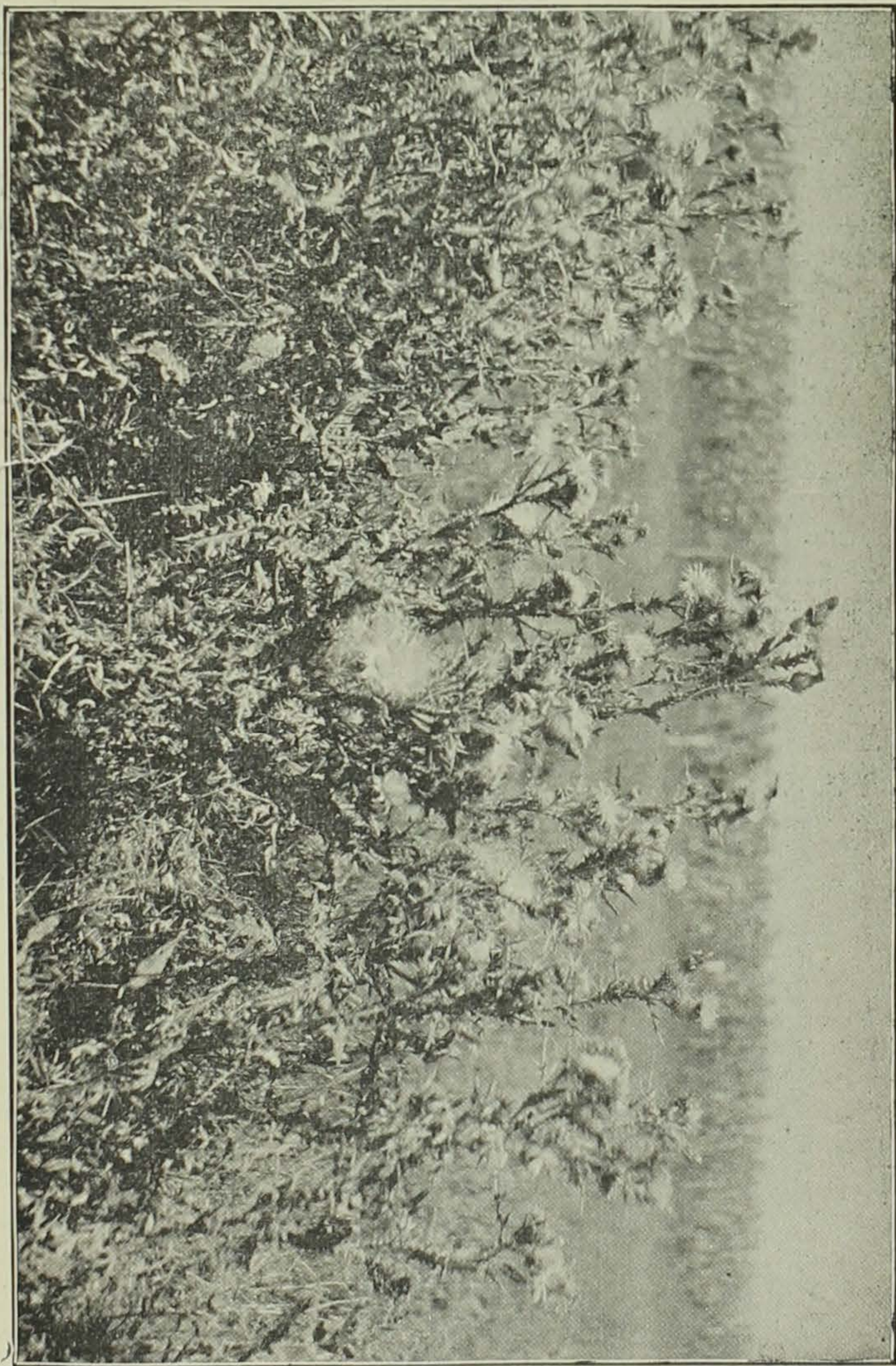
*Description*.—Branching biennial, three to four feet high,





Figure 88. BULL THISTLE (*Cnicus lanceolatus*). A common European weed in pastures. (Division of Bot. U. S. Dept. of Agriculture).





BULL THISTLE ALONG THE ROADSIDE



tomentose, becoming dark green and villous or hirsute with age, branchlets bearing large heads; leaves lanceolate, decurrent on the stem with prickly wings deeply pinnatifid, the lobes with rigid prickly points, upper face roughened with short hairs, lower face with a cottony tomentum; heads one and three-quarters to two inches high, bracts of the involucre lanceolate, rigid when young, more flexible with age, long attenuated prickly pointed spreading tips, arachnoid wholly; flower hermaphrodite, tube of the corolla ten lines long, anther tips acute, filaments pubescent, achenes smooth, one and a half inches long, pappus of numerous plumose bristles.

*Distribution.*—It is a troublesome weed in pastures along roadsides in all parts of the state, most abundant in forest clearings. Johnson, Decatur, Guthrie, Woodbury, Lee, Emmet, Allamakee, Carroll, Boone, Dubuque, Fayette and Appanoose counties; Ames, Glendon, Keokuk, Des Moines, Muscatine, Grand Junction, Tama, Belle Plaine, Marshalltown. Distributed in North America in fields and waste places from Newfoundland to Georgia, Missouri, Kansas to Nebraska, the Dakotas and Idaho. Naturalized from Europe, native also to Asia.

*Extermination.*—This weed should be treated like all other biennials. The most important point is to prevent the seeds from forming. For this purpose the plant should be cut off in the early spring. The seeds germinate in the spring and the first season produce a flattened mass of leaves. The second season the flowering stem shoots up rapidly and early in August the flowers begin to appear and these are continued till frost.

## WEEDS OF GARDEN CROPS

### PRICKLY LETTUCE.—(*Lactuca Scariola*, L.)

For some years much interest has been manifested in the appearance of prickly lettuce in western states, particularly Illinois, Iowa and Indiana, so much so, that Dr. J. C. Arthur of the Indiana Station, has published an extended account. Prof. Morrow also issued a press bulletin. The writer also published an account of the same weed.

*Description.*—Tall, erect herbs, glaucous green, two to six feet high, simple or branched except the lower part of stem which has stiff bristles. Leaves glaucous, green, smooth except the midrib which is beset with weak prickles; lanceolate to oblong in out-

Wild or Prickly Lettuce, Bull. Ind. Agrl. Exp. Sta. 52: Nov. 1894.

Bull. Ia. Agrl. Exp. Sta. 28: 199.



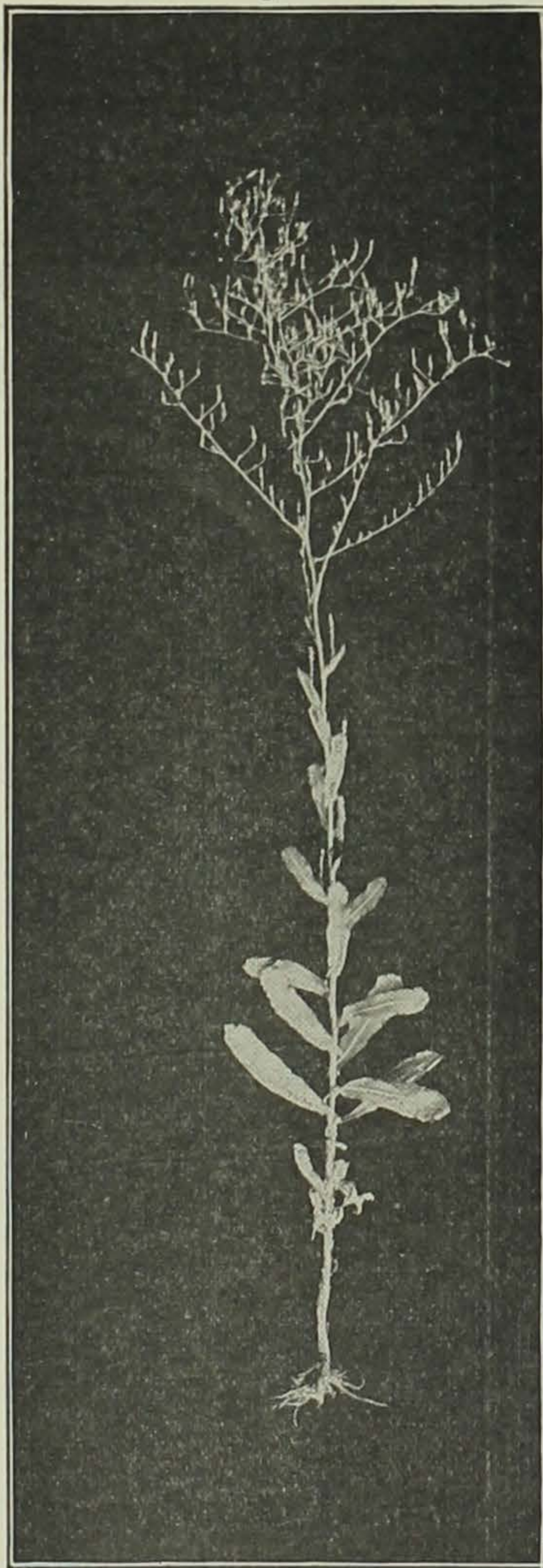


Figure 90. PRICKLY LETTUCE (*Lactuca Scariola*). A weed allied to the lettuce and widely distributed in the United States. (Arthur, Ind. Agr. Ex. Sta.)



line with spinulose denticulate margins occasionally sinuate toothed.

Dr. Gray says sometimes pinnatifid, but such leaves have not been observed here; base sagittate-clasping. Leaves becoming vertical by a twist. It is therefore one of the compass plants. In shady situations the leaves are not twisted. Flowers produced in small heads; these occur in open panicles. Each head has from four to eighteen yellow flowers, akenes flat, striate nerved obovate oblong, produced into a long filiform beak, the latter is paler in color than the akene. The pappus consists of a delicate white down, the separate parts arise at the end of the beak. The whole arrangement of the akene is a contrivance for scattering the seed. As to duration, prickly lettuce is an annual or generally a winter annual. This condition depends somewhat on the state of the weather in the fall. During a moist fall thousands of little plants may be seen everywhere in Iowa. All parts of the plant contain a milky juice, the latter occurs in plants of widely separated families, as milkweed (*Asclepias cornuti*), Opium plant (*Papaver somniferum*) etc.

*Relationship of the Plant.*—This weed is undoubtedly closely related to our cultivated lettuce (*Lactuca sativa*) and as Dr. Arthur says most closely resembles the Cos varieties of lettuce. Prof. Bailey indeed considers that our cultivated lettuce originated from this plant.

DeCandolle says:

Botanists are agreed in considering the cultivated lettuce as a modification of the wild species called *Lactuca Scariola*. The cultivated lettuce often spreads from gardens and sows itself in the open country. No one as far as I know, has observed it in such a case for several generations, or has tried to cultivate the wild *L. Scariola* to see whether the transition is easy from the one to the other.

Some years ago the writer collected in a waste place in western Wisconsin escaped specimens of the cultivated lettuce. While the stem at its base had bristles, the leaves in no way resembled our prickly lettuce in outline, and the bristles on midrib. We may therefore regard our plant as a good species and the cultivated form as a variety.

In Utah and other western states another European lettuce has become naturalized, namely *Lactuca virosa* which is quite as troublesome as the prickly lettuce. Several distinct wild species of lettuce occur throughout Iowa. None, however, are troublesome to the farmer. Some of these go by the common



name of fire weed. All of these plants are members of the sunflower family and known botanically as *Compositae*.

*Distribution.*—Prickly lettuce is a native of temperate and southern Europe, Canary Islands, Maderia, Algeria, Abyssynia and temperate regions of eastern Asia. It was introduced into North America about 1863. Collected by Mr. D. Murray in 1863 and 1864 and was first reported by Dr. Gray.

Since then it has become very common in the eastern states and in the Mississippi valley north of Arkansas spreading westward to the Pacific coast by way of Montana and Idaho.

The writer has recently observed it in Denver, Fort Collins, and Golden, Colorado, Salt Lake City, Utah, also in Wyoming, Hastings, Crete and Lincoln, Nebraska.

It has taken a quarter of a century for the weed to become numerous, but isolated specimens in the Mississippi valley were reported eighteen and twenty years ago. Now it is almost beyond control. The writer in 1887 called attention to the weedy nature of this plant and advised its extermination.

Mr. G. P. Clinton says:

Perhaps no plant has attracted more attention by its apparently very rapid spread than has this during the past two or three years. It is said that the plant was introduced into this country from Europe, the first specimen being found at Cambridge, Mass., in 1863. In this state, while to many it appears as a new weed, it has been observed in several localities for a number of years. Dr. W. S. Moffatt in a letter, states that he has known the plant to occur in the vicinity of Chicago for at least fifteen years, and as early as 1879 plants were collected at Rockford by Mr. M. S. Bebb. At the present time the plant is one of the most common in waste places. It belongs to the composite family, and is thought by some to be a wild form of cultivated lettuce to which at least it bears close relationship. The seeds begin to germinate either in the fall or early spring and at first form a circle of leaves spreading flat on the ground.

Prof. Arthur well says:

Here is a vigorous weed almost as common as ragweed, and bidding fair to become common everywhere, with no strong features to catch the eye, so that unless in masses it escapes notice until attention is called to it, and with unrivaled fertility and means of dispersion. Prof. Morrow thinks that to destroy it will require concerted "action of farmers, roads commissioners and owners of village lots" to check its further spread, with which we agree; and furthermore, we believe that if this concerted action were brought about all over the country, and continued without interruption for a term of years, some hope of extermination," he says, "is in preventing it from seeding;" but immediately action of so large a number of citizens throughout the whole country was never yet secured for any object whatever, and to

Gray's Manual of Botany 280. 1867.

Prairie Farmer, Jan. 29, 1888.



base any scheme upon such a contingent is little short of absurd, and at best is visionary and doomed to failure. Mr. Clinton must have felt this when impelled to make a dampening commentary upon his own advice to farmers: "The best method of destruction," he says, "is in preventing it from seeding;" but immediately adds that "this, however, will do no good unless carried on all over the country." What shall the poor farmer do? He seems to be between Scylla and Charybdis. He must either stand by and see his land usurped by a vigorous foreigner, or he must knowingly fight the foreigner to no purpose, because all other land tillers and owners are not of a mind to fight at the same time. Mr. Wheeler evidently saw something of the magnitude of the undertaking which he urged, when he put these words at the end of his advice to farmers: "United effort and eternal vigilance on the part of all land owners will be required to stop the spreading of the pest." It is scarcely to be believed that he seriously anticipated any such zeal on the part of land owners. It may be that a million dollars judiciously expended by the general government would not exterminate the Russian thistle from American soil, but it is doubtful if any available number of millions could bring about the extermination of the wild lettuce.

We cannot here dwell on the distribution of the weed, but must refer the reader to Arthur's excellent account, and a paper by the writer in Volume II, p. 109 of the Proceedings of the Iowa Academy of Sciences. In Iowa it is common from Dubuque west to Webster City, southwest to Atlantic and to the western line of the state.

What shall be done with the weed? The weed is easily exterminated by cutting off young plants below the ground in cultivated fields and waste places. Where the stem is cut off below the surface of the ground it will give no trouble, but in meadows and lawns where the plants are cut off above the ground the weed will continually reappear producing from three to half a dozen branches. The following excellent suggestions are made by L. H. Dewey.

Sheep and sometimes cattle will eat the young prickly lettuce, and in some localities their services have been found very effective in keeping it down, especially in recently cleared land where cultivation is impossible. Repeatedly mowing the plants as they first begin to blossom will prevent seeding and eventually subdue them. Thorough cultivation with a hoed crop, by means of which the seed in the soil may be induced to germinate, will be found most effective. The first plowing should be shallow, so as not to bury the seeds too deep. Under no circumstance should the mature seed-bearing plants be plowed under, as that would only fill the soil with seeds buried at different depths to be brought under conditions favorable for germination at intervals

Bull. Ind. Agrl. Exp. Sta. 39.

Weeds and how to kill them. Farmers' Bull. U. S. Dept. of Agrl. 28.



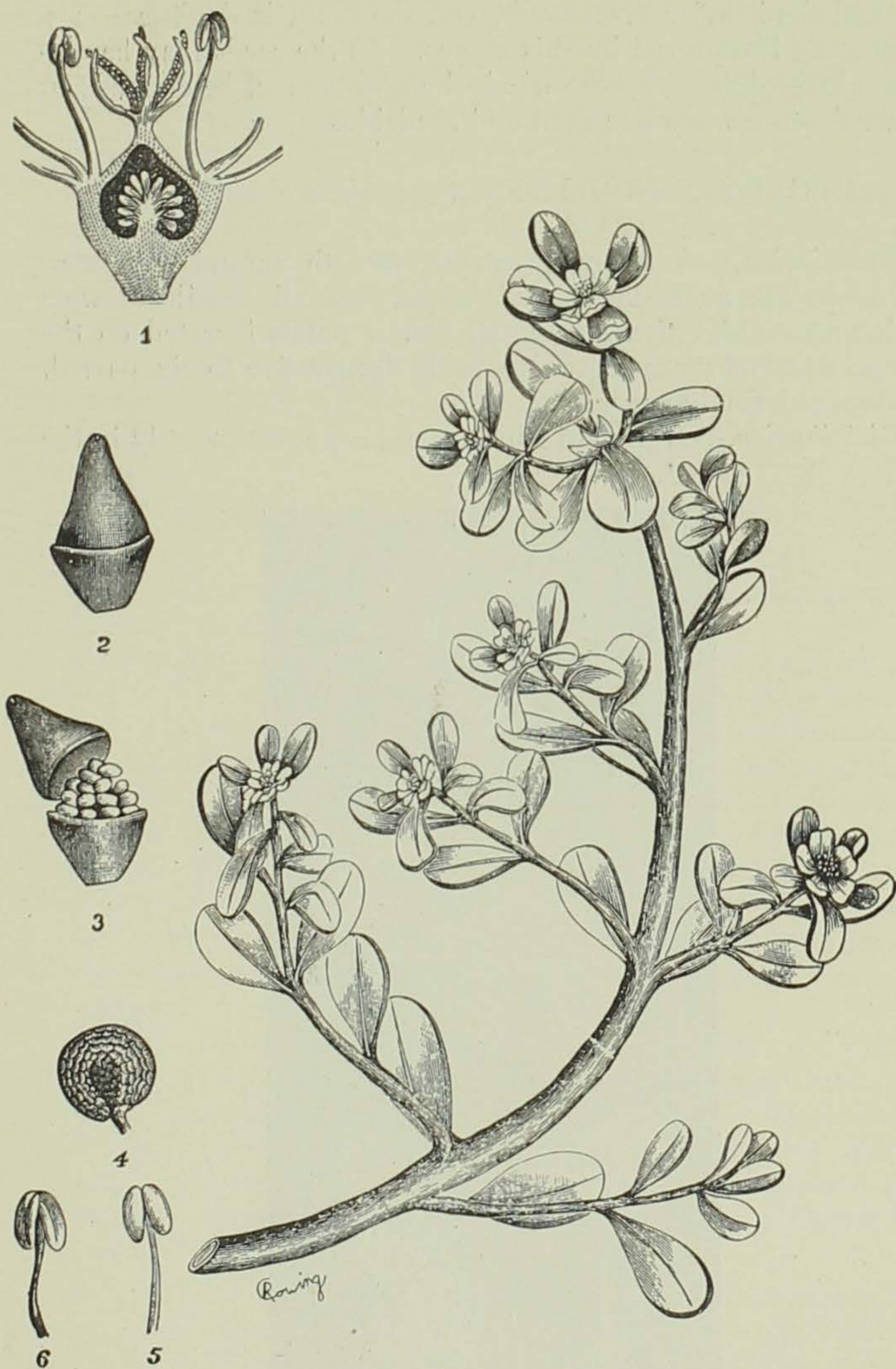


Figure 91. PUSLEY (*Portulaca oleracea*). An abundant garden weed. (Division of Bot. U. S. Dept. of Agriculture).

for several years. Mature plants should be mowed and burned before plowing. The seed appears as an impurity in clover, mil-



let, and the heavier grass seeds, and the plant is doubtless most frequently introduced by this means. As the seeds may be carried a long distance by the wind, the plants must be cleared out of the fence rows, waste land and roadsides

PUSLEY, PURSLANE,—(*Portulaca oleracea*, L.)

*Description*.—A fleshy, prostrate, smooth annual with scattered obovate or wedge-shaped leaves. Small sessile flowers with a two cleft calyx, five small yellow petals inserted on the calyx; stamens seven to twelve, style deeply five to six parted. Seeds small, finely rugose.

*Distribution*.—Native to Europe, and common not only in the

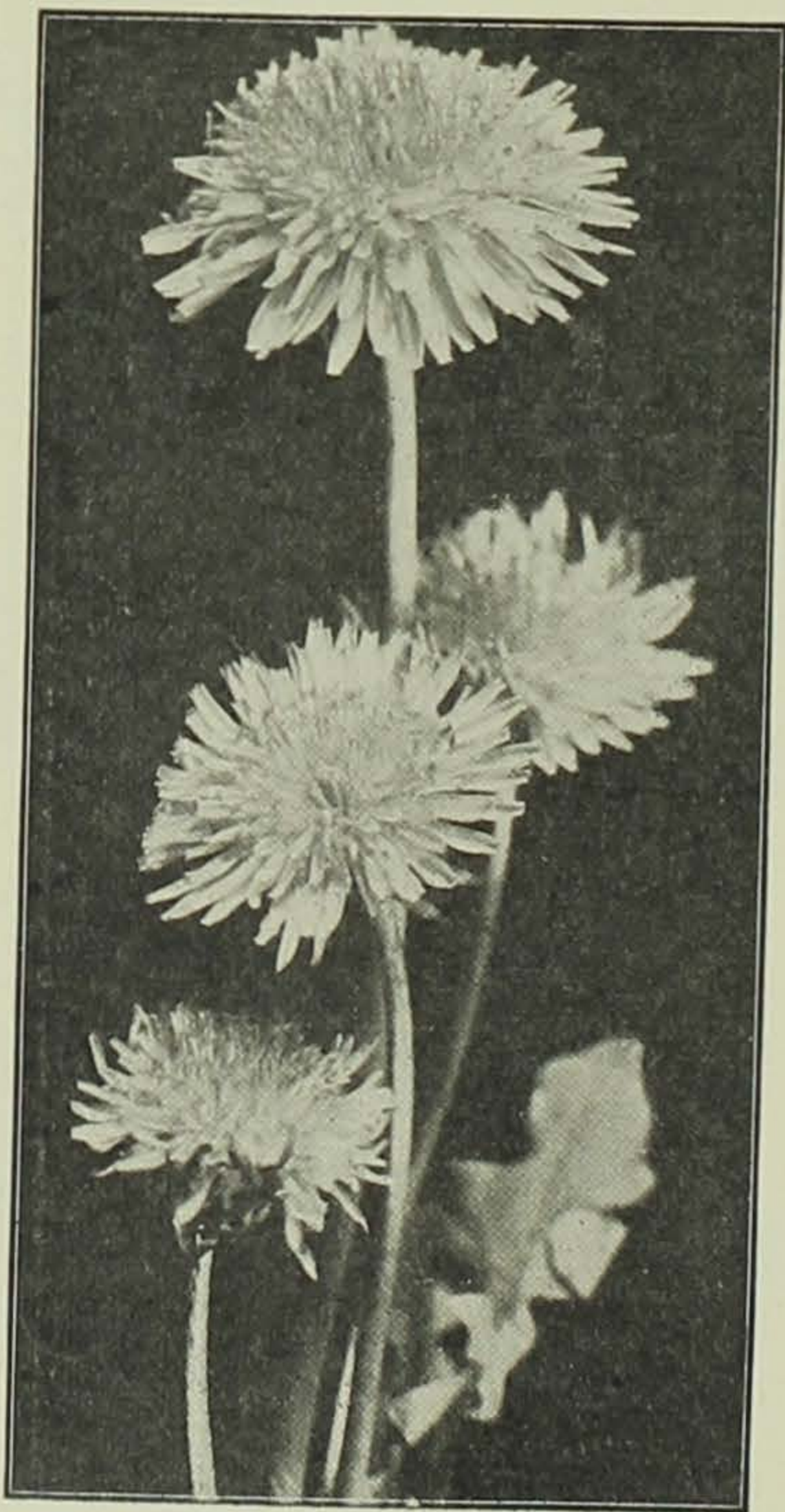


Figure 92. DANDELION (*Taraxacum officinale*). A common weed of the lawn and garden. (Photo Charlotte M. King).



eastern states but in the Mississippi valley, southern states, Rocky mountain region and Pacific coast. So thoroughly has it become established that it is impossible to say whether it is native or introduced, except for the early records. There are supposed to be some native forms in the southwest.

*Extermination.*—Although pusley is an annual it is more difficult to exterminate than any other weed of the garden. Its fleshy leaves and stems retain their vitality for some time. Cutting the weed off or covering it will not remove the plant, as the severed stems soon strike root at the nodes. So too, the partially covered plants invariably start to grow again. The weed must be removed from the field or garden. It is best to make the weeds into a compost heap.

DANDELION.—(*Taraxacum officinale*, Weber.)

The dandelion is one of the very troublesome weeds in gardens and lawns found in all parts of the state.

*Description.*—A smooth or at first pubescent biennial or perennial. The many flowered head borne on a slender hollow scape. The root leaves pinnatifid or runcinate. The involucre double the outer of short scales, the inner long linear erect in a single row. After flowering the inner involucre closes, the fruit is ripened close to the ground, and when ripe the hollow scape elongates. The whole involucre is reflexed permitting the wind to scatter the "seeds." The "seeds" (achenes) are oblong, long beaked; the beak is two or three times as long as the remainder of the achene, bearing at the end long soft white capillary threads the pappus.

*Distribution.*—Common in Ames, Marshalltown, Cedar Rapids, Carroll, Armstrong, Mason City, Des Moines, Dubuque, Clinton, Council Bluffs, Burlington, Muscatine, Davenport, Bloomfield, and many other points in the state. Native to Europe and also Asia, but naturalized or perhaps indigenous far northward. Common in the Rocky mountain country, Colorado, Wyoming, Utah and westward.

*Extermination.*—The dandelions are not difficult to exterminate in cultivated fields but in garden crops it is more difficult to do so, especially in strawberry beds. As the dandelions are perennial or biennial herbs seed formation should be prevented. Where they occur in small patches a spud may be used successfully. Where they are abundant in lawns it is only neces-



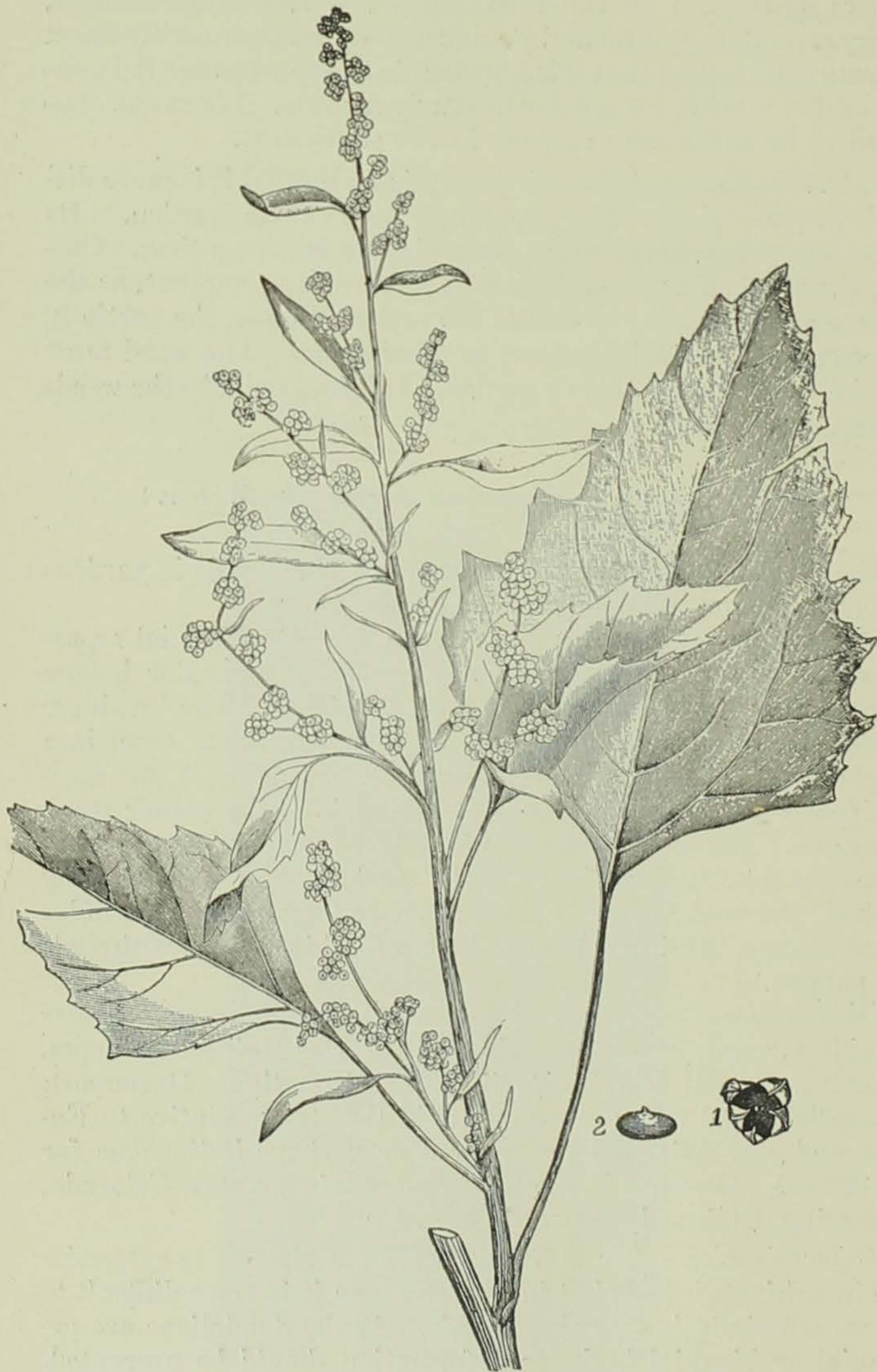


Figure 93. LAMB'S QUARTER (*Chenopodium album*). - A common garden weed. (Division of Bot. U. S. Dept. of Agriculture).



sary to keep the lawn closely cropped and dig them up with a small spud to prevent seeding. Blue grass and clover, especially the latter, will crowd them out. It is rarely that dandelions give trouble after the middle of June.

LAMB'S QUARTER—PIGWEEED.—(*Chenopodium album*, L.)

This weed is also quite generally distributed in fields and



Figure 94. HORSE WEED (*Erigeron Canadensis*). A widely distributed weed in North America, also occurring in Europe. (Charlotte M. King).

gardens.

*Description.*—An erect annual from one to four feet high.





Figure 95. SHEPHERD'S PURSE (*Capsella Bursa-pastoris*). Common everywhere in northern United States. (Division of Bot., U. S. Dept. of Agriculture).



Young plants generally mealy, older plants smooth. Leaves rhombic ovate to lanceolate or the upper sometimes linear, acute, the lower commonly toothed. Flowers produced in clustered dense spiked panicles; calyx five-parted, nearly covering the seed. Seeds surrounded by a loose pericarp forming a utricle.

*Distribution.*—Native in Europe and Asia. Commonly naturalized in eastern North America from Europe, common also in the Rocky mountain region, Utah and the Pacific coast.

*Extermination.*—The species produces an enormous number of seeds. The young plants are easily destroyed by cutting off below the ground. Covering the young plants is not effective unless the entire plant is covered. Older plants may be destroyed by pulling them up. The weed on account of the shade it produces destroys other vegetation underneath it.



Figure 96. HORSE RADISH (*Nasturtium Armoracia*). A commonly cultivated crucifer, a frequent escape from cultivation. (Charlotte M. King.)



HORSE WEED.—(*Erigeron Canadensis*, L.)

Horse weed (*Erigeron Canadensis*) or Canada fleabane is a common weed in many sections of our country. This is especially true of the northern Mississippi valley states.

*Description*.—Bristly, hairy stem or sometimes glabrate, one to six feet in height, simple or paniculately branched. Leaves usually pubescent or ciliate, the lower spatulate, incised or entire, obtuse or acutish, the upper generally linear and entire. Heads numerous with inconspicuous white ray flowers shorter than the pappus; pappus simple.

*Distribution*.—Common throughout eastern North America, except far northward. Common also in the Rocky mountain region, and in waste and cultivated grounds along the Pacific coast, appearing as an introduced weed. Also an introduced weed in the old world and in South America.

*Extermination*.—This weed is an annual and is very easily destroyed. Cutting off just below the surface of the ground will exterminate it, provided, of course, that the new seeds are not permitted to re-seed the soil. The weed is common everywhere and the fact that it is so easily blown by the wind makes it difficult to keep it in check.

SHEPHERD'S PURSE.—(*Capsella Bursa—pastoris*  
Moench.)

*Description*.—An annual or winter annual, a foot to a foot and a half high, root leaves clustered, nearly divided or merely toothed, stem leaves sessile. Flowers small, white, in fruit spreading. Pods much wider above than below, many seeded. Seeds light brown, elongated with a prominent ridge. Mucilaginous when moistened with water. Cotyledons incumbent.

*Distribution*.—One of the commonest weeds everywhere in eastern North America from Nova Scotia to Florida, west to Texas and the Pacific coast. Thoroughly cosmopolitan, as common in Europe as in the United States. It is represented in the Iowa State College Herbarium by Iowa specimens from Ames and Iowa City, (A. S. Hitchcock); Keokuk, Lawler, and LeClaire (P. H. Rolfs); Ames, (E. S. King, P. H. Rolfs); Muscatine, (Ferd, Reppert); Greenfield, (F. C. Stewart); LaCrosse, Gray. Botany of California. 1: 332.



Wis., (L. H. Pammel). It has been observed throughout the state. It occurs in every village and city in the state; not a farm but where it is found.

*Extermination.*—This weed is an annual and hence by cultivating the soil in the fall and repeating this cultivation in the spring it may easily be removed.

#### HORSE RADISH.—(*Nasturtium Armoracia*, Fries.)

*Description.*—A stout perennial with long and deep roots. Leaves large, oblong, crenate or pinnatifid, the latter produced in the spring. Stem leaves lanceolate, or oblong cordate. Flowers with four green sepals and four white petals, not common. Pods short, globular, but fruit seldom found. At least I have never observed any in Iowa.

*Distribution.*—It is native to the eastern parts of Europe—Turkey, Greece and the Caspian Sea through Russia, Poland and Finland. In Germany France, Sicily, Norway and Great Britain it has escaped from cultivation.

Horse radish, although a well-known condiment, is a pernicious weed in many places.

*Extermination.*—The horse radish is one of the most persistent of our weeds; no other weed will stand such rough treatment. It may be hoed and cultivated and still it persists in coming up. Some years ago we tried the following plan: The land was plowed, then harrowed; the roots were picked up and the process repeated after the lapse of a week, when the young plants made their appearance. After that, young plants were cut off with a hoe below the ground as soon as they appeared. This treatment was kept up for two years, and in this way most of it was removed. Quack grass near the horse radish received the same treatment and was killed in a single season. The season was a dry one. Very little progress in destroying the plant would have been made in a wet season.

### POISONOUS WEEDS

The question of plants poisonous to live stock is one that is of considerable interest to stockmen. The losses in the aggregate in various sections of the country amount to a very considerable sum. However, it is only occasionally that large numbers of animals are killed by eating poisonous plants. The subject of weeds poisonous to live stock has been discussed in considerable detail



by various writers, among which we may enumerate Mr. Chestnut and Dr. Wilcox.



Figure 97. COWBANE (*Cicuta maculata*). A very poisonous plant belonging to the carrot family. (Chestnut Division of Bot., U. S. Dept. of Agriculture).

Papers have also been published by other station workers like Nelson and Hedrick, a paper by Dr. Richmond, several papers and bulletins on the subject of loco weeds and loco poisoning.

Principal Poisonous Plants of the United States. Div Botany, U. S. Dept. Agrl. 20.

Thirty Poisonous Plants of the United States. Farmers' Bulletin, U. S. Dept. Agrl. Office of Experiment Stations. 86.

Preliminary Catalogue of Plants Poisonous to Stock. Rept. Bur. Animal Industry. 15: 387. 1898.

Chestnut and Wilcox. The Stock Poisoning Plants of Montana. A Preliminary Report. Bull. U. S. Dept. Agrl. Div. Botany. 26.

Some Poisonous Plants of the Northern Stock Ranges. Yearbook, U. S. Dept. Agrl. 1900: 300, pl 32-34.

Feeding Wild Plants to Sheep. Rept. Bur. Animal Industry. 15: 421.

Bull. Oregon Agrl. Exp. Sta. 46.

Rept. Vermont Agrl. Exp. Sta.



But aside from the interest to stockmen the subject is of more than passing interest to physicians and people generally. A few weeks ago there appeared in the daily press the announcement of the death of two children in Glenwood who had eaten some poisonous weed. The following press bulletin gives the status and history of this case. Cases of this kind occur every season in this state. No doubt several deaths must annually be recorded from the consumption of cowbane or other poisonous weeds.

The following from a press bulletin gives an account of the poisoning from cowbane in Glenwood.

The press dispatches a few days ago gave an account of the poisoning of three children in Glenwood, Ira aged ten and Ross aged eight years, children of T. Y. Johnson. Two of the children died of the effect, while John aged seven years, a son of Mrs. Amanda Kingery, ate of the root but was not fatally poisoned. Some of the material was forwarded to me by Mr. Irvin J. Erhli-man of Glenwood. The plant proved to be cowbane also known as the water hemlock or muskrat root or beaver poison, a plant belonging to the carrot family. Both of the local papers, the Glenwood Opinion and the Mills County Tribune had accounts of the poisoning, the account in the latter is as follows:

Ira, aged ten, and Ross, aged eight years children of T. Y. Johnson, died last night from eating the roots of a poisonous water plant that grows in front of their house on the Keg Creek flat east of the Ridgeway lumber yard. A third child, John, the seven year old son of Mrs. Amanda Kingery, also ate the root but it seems was not made so sick as the others.

Shortly before six o'clock the children came into the house showing Mrs. Johnson what they had been eating. Not knowing what it was she had them spit it out and throw away what they had in their hands. They went out to play again, but in about twenty minutes the two Johnson boys fell to the ground as if in a fit, soon passing into convulsions. The Kingery lad was able to walk to his home, but was soon taken with spasms. Dr. Hester was called and by a vomiting process in a few hours had the child on safe ground.

Dr. Lyon was summoned to the Johnson home, getting there at 6:30. The little fellows were already in terrible convulsions and nothing could be done for them, one dying at 6:45 and the other at 7:15.

The following account of poisoning occurred in the Oskaloosa Herald of April 13.

Council Bluffs, April 13.—The 5-year-old son of Joseph Yocum, of Weston, is dead and his 8-year-old son is still in a critical condition, the result of eating some poisonous plant growing near their home. It is supposed they ate either of the blue lily or the

Frederick B. Power. Notes on the so-called Loco Weeds. *Pharmaceutische Rundschau*. June, 1889: 136.

M. Stalker, Rept. Dept. Botany, Iowa Agrl. Coll. 1884: 114.

C. E. Bessey. Notes on Poisonous Plants of Nebraska. *Proc. Soc. Prom. Agrl. Sci.* 23: 34.



wild parsnip, the symptoms in either case being almost alike.

The blue lily referred to here is *Iris versicolor*. The poisoning was most likely caused by cowbane.

In 1895 the writer published a bulletin giving in detail some of the facts in connection with this weed. This was published in response to an inquiry from Mr. J. A. Minter of Hartley in northwestern Iowa who lost several head of cattle by eating the roots of this weed. Since the publication of this paper other cases have been referred to in the press and some additional facts have been found out with reference to the plant. As this bulletin is out of print we take the liberty of republishing it in part.

*Description.*—It is a smooth marsh perennial two to five feet high with pinnately compound leaves two or three times pinnate; the leaves have long petioles, the coarsely serrate leaflets are lanceolate to oblong lanceolate one-fifth inch long. Stalks of the umbellets numerous and unequal. Flowers white, fruit broadly ovate to oval, small  $1\frac{1}{2}$  inches long. Grows in marshes and in low grounds. The stems spring from thick fleshy underground roots that taper at the lower end. These usually number from three to five but single specimens are also met with. On cutting the roots a sharp pungent odor is given off, intensified in boiling.

*Distribution.*—This plant is found throughout the Atlantic states as far southwest as Louisiana, west and north to Iowa, Minnesota, the Dakotas, Nebraska and through the Rocky mountain region of Colorado, Wyoming and Montana to the Uintahs. In the west this plant is generally replaced by an allied species the *Cicuta vagans* of Greene.

*Poisonous Property.*—Its poisonous properties have been worked out by several chemists. The poisonous property of the plant resides in the root and stem, but more particularly in the root. It seems to occur in an aromatic oily fluid.

Mr. Chesnut says:

Its true chemical nature is not exactly known, but it is highly probably that it contains the alkaloid conine, and the bitter principle cicutoxin, the latter of which is characteristic of the European water hemlock (*Cicuta virosa*). Both are powerful poisons, but the latter is the more violent and produces most of the symptoms characteristic of the plant. The American water hemlock is one of the most poisonous plants native to the United States. Its victims include both man and animals. The underground parts are the most poisonous, and are especially dangerous, because they are often washed or frozen out of the soil and thus exposed to view."



In regard to the Oregon hemlock (*Cicuat vagans*, *Greene*), Prof. Hedrick of Corvallis, Oregon, believes that more than 100 cattle are killed every year in Oregon. A piece of the root stock of the size of a walnut was sufficient to kill a cow during the winter and a piece about the size of marble is dangerous to man.

Prof. Hedrick found that the roots were most poisonous in the autumn and winter. Concerning this point he says:

During the next few weeks a number of "sure" remedies were recommended. The most common of these are lard, bacon grease, milk and flour. The milk has proved to be worthless in the first experiments, but to satisfy ourselves regarding the other named remedies, and to try some of a more medicinal nature, another animal, early in May, was fed several of the poisonous bulbs. The bulbs were of the same lot used in the first experiments, but had been growing for a month in a green house. It was expected that growth would remove some of the dangerous properties of the bulbs, but it was a surprise to find that an animal eating many times as much of them as had killed the cows in the previous experiment suffered no ill effects whatever. The conclusion is obvious; the bulbs are only dangerous poison when in the dormant state, or for a short time after growth begins in the spring. Cattle are likely, then, to be poisoned only from the first of January to the middle of May.

Some years before this Dr. McCord working under the writer's direction made some experiments here at Ames. The first experiment was upon a rat which was secured and anaesthetized; it was given a hypodermic injection of one dram of the decoction prepared from the root. In almost one hour the animal seemed to be in more or less pain and shortly afterward appeared in a comatose condition, remaining in that condition for about two hours and after that seemed apparently well. The second experiment was performed upon a dissecting specimen of the equine species at the hospital September 29th. It was given one dram of the decoction hypodermically without any effect; September 30th, gave the same animal one-half ounce of the same root macerated with the feed without any results. Some of the fresh root was obtained and a very strong decoction was made of it; on September 31, gave the animal six drams of the decoction hypodermically. In about ten minutes the animal began to show uneasiness, pulse was dull and fast. In a short time the patient laid down and the pulse decreased. The patient seemed to be in a distressed pain, stretching full length on the ground and pointing to side with the nose, pulse at that time hardly discernable, kept moving extremities. This lasted for about one-half hour when the patient began to get better and soon recov-

Bull. Oregon Agrl. Exp. Sta. 46: 9.



ered. Another experiment was made on a cat, macerated a portion of the root with some potato, the animal ate it without disturbance—this was at noon. In the evening it received 20 cc. in milk; the animal showed no signs of uneasiness, at about nine o'clock it received a subcutaneous injection of four drams without any effect. Dr. McCord concluded that the cat could eat it with impunity. These roots were all collected in the summer and it is very probable that the reason why the animals did not succumb was because the roots were simply less poisonous than they are in the spring and winter.

Prof. Henry Trimble of Philadelphia writes me that the general opinion of farmers in that locality is that it is very poisonous to cattle, and that one of the students found that the dried root had no effect on a cat, but when administered as soon as gathered it produced great uneasiness and vomiting in five gramme doses. The writer of this paper has eaten small portions of the root on several occasions. The effects remained a long time producing numbness in the mouth and pharynx.

In the following Iowa cases death was certainly due to poisoning from this plant.

In 1893 the writer received from Eugene Brown of Mason City in Cerro Gordo county some root of the so-called wild parsnip which had poisoned three boys respectively, five, seven and nine years of age. The cases recovered. The specimens sent me proved to be cowbane (*Cicuta maculata*).

The following note by Professor A. A. Crozier is of interest:

"Hon. Eugene Secor of Forest City, this state, a member of the Board of Trustees of the Iowa Agricultural College, brought me to day a fleshy root of a plant of the water hemlock, (*Cicuta maculata*). The circumstance which brought it to his notice were as follows: A neighbor of his by the name of Mr. Oleson, a farmer of about fifty years of age, while dragging some potato ground upon bottom land about two weeks ago discovered one of the fleshy roots of this plant, and supposing it to be an artichoke, ate it and gave a portion of it to his two sons. He soon began to feel queer or "funny" as he expressed it, and went to the house where he was taken with a spasm, followed by two or three others, when he became unconscious and within half an hour, before a physician could be summoned from the village, two miles distant he was dead. The children had probably eaten less of the root and being given an emetic, recovered. The plant is very common in the state and the roots are so pleasant to the taste to make it particularly dangerous. I may add that I ate a piece of the root the size of a filbert with little or no unpleasant effect.



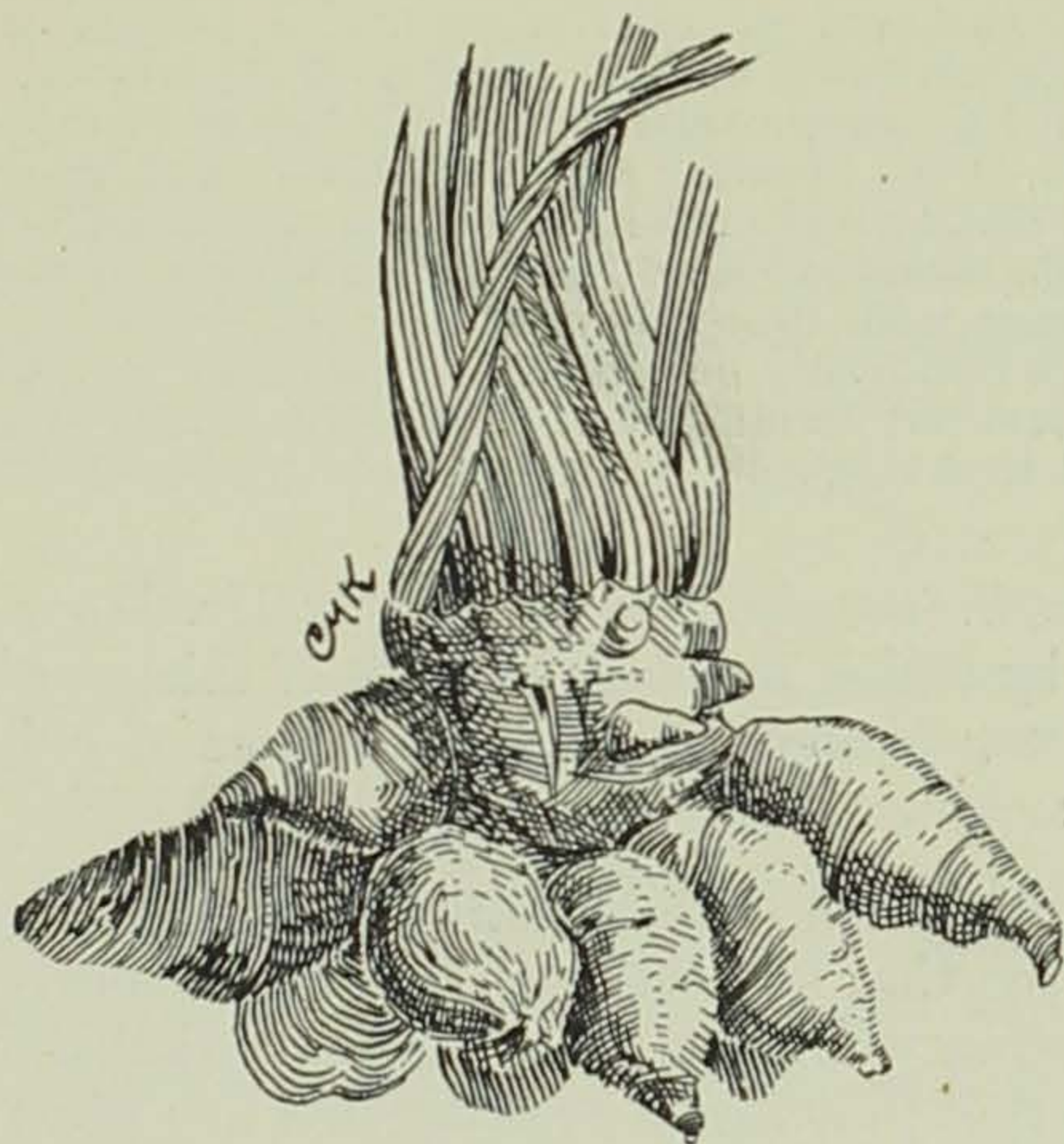


Figure 98. ROOTS OF COWBANE. Specimens received from Glenwood, Iowa. The roots similar to those which poisoned the Johnson children. (Charlotte M. King).

I also insert the following interesting letter from J. A. Min-  
teer of Hartley, Iowa:

Gentlemen: I have just had a strange experience with my cattle, having lost a four-year-old cow and a yearling calf. I think that they were poisoned on some kind of weed root found in the slough. I locate it on a spot where a hay stack stood about two years ago. It had been removed except the spoiled hay in the bottom. Last fall being dry, I pitched it up, dried and burned the old hay, sowed rye and timothy seed, ran the disc harrow over it several times and noticed that we turned out lots of roots like small sweet potatoes, except that they were all connected at the top. I thought they were the root of a weed that grows a stalk similar to seeded parsnip. It has a "strangeley" top similar to an elder berry when in bloom. The stalk when mature is hollow. Now I am not certain that I am right about the tops as it had been mowed before I discovered the tubers. I never thought of them doing any harm, just thought we had torn them out so they would die and do me no harm, but as the cattle, seventeen in number were brought up Sunday evening they appeared to be all right until they came into the barn yard when a cow fell down and seemed to have a spasm. It only lasted a few minutes when she got up walked about 100 feet and fell again, got up and walked about thirty rods, fell again and died in about thirty minutes. The yearling was all right until turned into the lot. In about twenty minutes she was taken in the same way except a little more severe, rose two or three times and died in about fifteen minutes. I was satisfied that they were poisoned, but the cause worried me for a while when I remembered the tubers I saw in the slough, I went next morning before turning the cattle out and found that the cow and yearling had been eating some of the



roots. I gathered up nearly one-half a bushel of the tubers, turned out the cattle and have had no trouble since. On opening the cows, I found considerable of the tubers in the stomach and the inside of the stomach was very black, and by scraping with a stick, I could scrape the inside of the stomach all off, as though it had been scalded. I will put a small piece of the stomach in the package with the tubers. Please let me know if the tubers I send are the deadly poison that I think they are, and how much of it is necessary to kill a cow. Some fall pigs have eaten some of the stuff from the cows stomach and it seemed to do them no harm.

Prof. James Wilson informs me that a Mr. Hoover of Traer was poisoned by eating some of the roots of this plant. The following additional observations on a few cases of poisoning may be of interest:

Mr. R. E. Buchanan, an assistant in the Department of Botany, informs me that two cases of poisoning occurred at Eagle Grove about seven years ago. Two boys ate what they supposed to be parsnips that they found growing in a low piece of ground. They took sick soon after eating and one of the boys managed to get to a house which was not far away and the second boy was later carried in. A physician was summoned immediately but the second boy died shortly after his arrival. Emetics were used on the other boy and his life was saved.

*History.*—The *Cicuta virosa* of Europe has long been known to be a very poisonous plant. European authorities like Lindley make this statement:

A most dangerous poison resides in the roots of this plant; a drachm of the fresh root has killed a boy in an hour and a half; and in America fatal accidents arising from its being mistaken for other apiaceous plants are not uncommon. It has been used as a substitute for conium, with similar effect, except that it is more energetic. A dangerous poison, producing effects similar to those of hydrocyanic acid. It appears to cause true tetanic convulsions and frequent paroxysms, and death on the third day. Haller considered it the conium of the Greeks. It appears to be fatal to cattle.

Robert Bentley says, "Water hemlock or cowbane is another indigenous plant of a highly poisonous nature, *C. maculata*, a na-

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Lindley Flora Medica. 34.

Man. Bot. 537. [Ed. 3.]



tive of America has very poisonous roots, which, for having been mistaken for harmless Umbelliferae, have not infrequently led to fatal results."

Dr. Masters says as follows of *Cicuta virosa* to which our species is closely related: "This plant is dangerously poisonous having qualities like those of conium; indeed it is called water hemlock. It produces tetanic convulsions and is fatal to cattle eating the herbage. In April, 1857, two farmer's sons were found lying paralyzed and speechless close to a ditch where they had been working. Assistance was soon rendered but the poor fellows soon expired. A quantity of hemlock grew in a ditch where they had been employed. A piece of root was subsequently found with the mark of teeth in it near where the men lay and another piece of the root was discovered in the pocket of one of them, so that there can be no doubt that they were poisoned by eating the root of this plant by mistake for some other. The root of the American *Cicuta maculata* is even more virulent."

The American plant has likewise long been considered to be poisonous.

An early writer on American Botany says:

Several persons searching for Angelica root, sweet flag, sweet cicely (which all have a pleasant smell and taste) have eaten this root by mistake, and some have died in an hour's time. The effects of the poison were violent convulsions, a frothing mouth, a bleeding nose, dilated pupils, etc.

Dr. Erwin F. Smith gives an account of a case of poisoning from this plant. He says as follows:

During the warm days which melted the snow and brought back the birds and gave indications of springtime, some children of a neighborhood on the outskirts of the city gave vent to their feelings by digging and eating some artichokes which grew upon some low ground bordering a brook. Two of these boys were taken violently ill, and one of them eight years old died within an hour after he had eaten the root. Dr. Smith states that upon an examination of the stomach and the root from which he ate it was proven beyond a doubt that *Cicuta maculata* was the cause of death.

Darlington says:

The mature fruit of this plant has a strong anisate odor. The root is poisonous, and the lives of children and others are often endangered and sometimes destroyed by eating it, in mistake of that of the sweet Cicely (*Osmorrhiza longistylis* D. C. The

Treasury of Botany. 284.

Rafinesque. Medical Flora. 1: 109-110.

Flora Cestrica. 104.



herbage is also said to be destructive to cattle, when eaten by them; all of which serves to show the importance of sufficient botanical knowledge, among the people, to enable them to understand and avoid or extirpate the evil.

Dr. Millspaugh, in his American Medicinal Plants, Fascicle 4, p. 67 has recorded the following observations concerning the physiological action of *Cicuta maculata*:

Many cases of poisoning from the root of this species have been reported, all showing, by the symptoms, that *Cicuta* produces great hyperaemia of the brain and spinal cord. The following case reported by letter to Dr. Bigelow by Dr. R. Hazeltine, (1818) gives all the symptoms noted by observers in all the other cases. A boy had eaten of certain tuberous roots gathered in a recently plowed field, supposing them to be artichokes, but which were identified as the roots of *Cicuta maculata*. His first symptoms was a pain in the bowels, urging him to an ineffectual attempt at stool after which he vomited about a teacupful of what appeared to be the recently masticated root, and immediately fell back into convulsions which occurred off and on continuously till his death. The doctor found him in a profuse sweat and convulsive agitations, consisting of tremors, violent contractions and distortions with alternate and imperfect relaxations of the whole muscular system, astonishing mobility of the eyeballs and eyelids, with wide-dilated pupils, stridor dentium, trismus, frothing at the mouth and nose, mixed with blood and occasionally violent and genuine epilepsy. The convulsive agitations were so powerful and incessant, that the doctor could not examine the pulse with sufficient constancy to determine its character. At the post mortem, no inflammation was observed, the stomach was fully distended with flatus, and contained about three gills of muciform and greenish fluid, such as had flowed from the mouth. This assumed a dark green color on standing.

Dr. Vasey makes this reference to the plant:

It is composed of a number of fleshy, oblong portions diverging from the base of the stem; frequently as long and as thick as a man's finger. It has a strong penetrating smell and taste. It is often mistaken by children for the wild parsnip, or is supposed by them to be eatable, and every year the papers contain accounts of fatal poisoning from the use of the root. It is highly desirable that information may be diffused respecting this and other poisonous and deleterious plants, so that such accidents may be avoided. The root has been to some extent employed by medical men. Its effects are much the same as the European Hemlock (no way related to the tree called hemlock in the United States) but is now rarely used.

### LOCO WEEDS.

The word is of Spanish origin and means "foolish." It is applied to certain plants, which when eaten by animals are supposed to cause a general derangement of the nervous and digestive

Bigelow, Amer. Med. Bot. 3: 181.

Rept. U. S. Dept. Agri. 1884: 135.



system. When ranchmen in the west speak of the loco plants, they generally refer to plants belonging to the genus *Oxytropis* and *Astragalus mollissimus*. In Iowa the Rattlebox (*Crotalaria sagittalis*) is the chief cause of "Loco" disease. In Australia species of the genus *Gompholobium* are troublesome to sheep, producing similar disorders. Some Lupines of the west produce poisoning especially of sheep.

All of these plants belong to the Pulse family (*Leguminosae*). Plants of other orders are said also to produce the same symptoms, especially *Corydalis aurea* var. *occidentalis*, a close relative of the "Bleeding Heart," so commonly cultivated in gardens. Both belong to the Fumitory family (*Fumariaceae*). Then, too, False Mallow (*Malvastrum coccineum*), a western plant, belonging to the Mallow family (*Malvaceae*), is said also to produce the "Loco Disease." Larkspurs and aconite have also been counted among the loco plants. These plants belong to the Crowfoot family. The Clover Family contains few poisonous plants. Yet a few, like Calabar Bean (*Physostigma venenosum*) contain powerful poisons. Several plants of the order are used as fish poisons. The orders *Fumariaceae* and *Malvaceae* contain some plants which are medicinal, though not nearly such active drugs as the Calabar Bean. We can sum up by saying that "Loco plants" occur in various parts of the world. They belong to orders of plants not always closely related. We can state with reasonable certainty from our present knowledge that some of them are capable of producing disturbances in animals and even death.

The subject of Loco weeds and the injury to stock in various parts of the United States has of late attracted considerable attention. For this reason veterinarians have given the subject more or less study, while pharmaceutical chemists have endeavored to discover the cause of such peculiar physiological disturbances. Though many excellent papers have been published, there is still room for investigation.

Several papers on the subject of Loco weeds, especially the chemistry have appeared. The paper by Dr. F. B. Power and Mr. Gambier goes into the chemistry quite carefully. The other by Prof. L. E. Sayre is a general paper touching upon the chemistry in less detail.

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Pharmaceutische Rundschau. 9: 8. 1891.

Biennial Report Kansas State Board of Agriculture. Part II. 7: 97.



It may be well to briefly review some of the earlier literature in this connection. It is a rather difficult task to get at the earliest recorded mention of this subject since the earlier articles first appeared in newspapers. It will be sufficient to state that supposed loco poisoning has been known for a long time. The earlier contributions made by Ormsby, Whipple, Rothrock, Vasey, Brewer and Watson, etc., were not based on experimental evidence. Nevertheless, these observers took some very careful notes on the conditions of the animals and the circumstances under which they become diseased. About this time chemists subjected some of the plants to chemical analysis, noting as well the physiological effect of the plant when given to animals. Dr. Horatio Wood, Jr., obtained an alkaloid from *Sophora speciosa*, which he called *Sophorin*. In its action it resembled the alkaloids of Calabar Bean. When given to a cat it produced profound sleep. The alkaloid is a spinal sedative.

Dr. Ott in 1882 made an experiment with *Astragalus mollissimus*. Its most marked physiological action seems to have been to decrease the irritability of the motor nerves, and also to greatly affect the sensory ganglia of the central nervous system with a tetanic action on the spine. "Has a stupefying action on the brain; reduces the cardiac force and frequency; temporarily increases arterial tension, but finally decreases it." The pupil of the eye is greatly dilated.

Dr. Mary Gage Day's paper shows quite conclusively that a decoction made from roots, leaves and stems of *Astragalus mollissimus* and *Oxytropis Lamberti* can produce death of cats, frogs and rabbits; and, as Prof. Power says, the symptoms are in perfect harmony with those that occur in horses and cattle. The physiological effect on larger animals has been shown in the case of *Crotalaria sagittalis*.

Dr. M. Stalker says:

When a strong infusion of the weed was given to an old horse with a stomach pump, in twenty minutes stupor began to ensue, the eyes were closed, the head was rested against the side of the box, the breathing became stertorous. At the end of six hours the stupor began to disappear, the eye began to regain its brightness, and in another hour the horse began to eat. The following day the horse was given half the quantity. The symptoms began to develop much more rapidly, and it died in half an hour. A second animal was experimented with, giving less of the infusion. On the fifth day the characteristic stupor came on. The animal rested its head against the box and slept while standing. The symptoms grew more marked until the thirteenth day, when the

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Notes on the so-called Loco Weeds, Pharm. Rund. 7: 136. 1889.

Bull. Dept. of Bot. Ia. Agrl. Coll. 1884: 111, 115.



animal died. Dr. D. S. Fairchild and Dr. Milnes, who helped to make postmortem examinations of five subjects, found great uniformity in the lesions presented. The animals showed hemorrhagic effusion in the fourth ventricle. The liver and spleen were very dense, while the intestines contained almost no blood. The stomach was very much distended.

Prof. Power and Mr. Gambier have obtained an alkaloid from the seed, which when fed (0.2 gramme) to a kitten, showed the following effects: Frothing at the mouth and a profuse flow of saliva, which continued for about half an hour. The animal fully recovered.

The views in regard to *Astragalus mollissimus* are much more discordant than in regard to the Rattlebox. President Ingersol has obtained entirely negative results in feeding a large quantity (a decoction from twenty pounds) to a lamb about two months old. In addition to this experiment, referred to by Prof. Sayre, he states that Dr. O'Brien has also had entirely negative results.

The fact should not be overlooked that locoed animals frequently contain intestinal parasites. A few years ago Dr. Stalker was sent out to investigate the matter of Loco Weeds for the Bureau of Animal Industry, and in a large number of postmortem examinations made, he found the bot-fly, and in all locoed sheep he found the tapeworm. Concerning the conditions in the horse he says: "I do not regard it as improbable, however, that the presence of the parasites had to do with the development of the abnormal appetite that leads the animal to crave what he would not otherwise touch.

*Chemistry.*—Miss C. M. Watson found a small amount of an alkaloid. The chemistry of some of the Loco weeds, up to the last paper by Prof. Sayre, can be found in the paper by Prof. Power, "Notes on the So-Called Loco Weeds."

The last paper by Prof. Power and Mr. Gambier is a very careful piece of chemical work. One kilogramme of the *Astragalus* herb gave 0.2 of a gramme of the alkaloid, equivalent to 0.006 per cent. Nothing further was determined concerning its nature, as it does not appear to be especially active. An extract from one kilogramme of the seed of the *Crotalaria* gave 1.1 grammes of an alkaloid, 0.036 per cent of the weight of the seed. It had a bitter taste, and seems to be more potent than that obtained from *Astragalus*. From these investigations the authors conclude that both the *Astragalus* and the *Crotalaria* contain very small amounts of toxic alkaloids, to which the symptoms of poisoning may be reasonably attributed.

Prof. Sayre, who has not gone into the details in the paper referred to, however, reiterates what he has stated in several previous ones, that it is a question whether so small amount of alkaloid should produce such grave physiological disturbances.



Grasses, with few exceptions, contain no deleterious properties, but it seems that one of our western species of *Stipa* (*S. viridula* var. *robusta*), is a good Loco weed. The effects on horses, and character of the plant are well described by an observing army surgeon, Dr. V. Havard. The grass has received the common appellation of "Sleepy Grass." Dr. Palmer, who collected the grass in Coahuila, Mexico, in 1889, noticed that it was considered poisonous to cattle, horses and sheep, giving them a temporary fit of sleepiness.

Dr. Havard says:

It would seem, then, reasonably established that this plant possesses narcotic or sedative properties, affecting principally horses, but also cattle and probably other animals; that animals are not fond of it, but eat it inadvertently or when under stress of hunger; that cases of poisoning occur, especially in the spring, when the radical and lower blades first come up; and that the active principle resides in these blades, and perhaps only during that season.

#### PURPLE OR STEMLESS LOCO WEED.—(*Oxytropis Lamberti*, Pursh.)

Although the loco weeds are common in the west we have but a single species that is commonly referred to as the loco weed in this state, namely, the purple or stemless loco (*Oxytropis Lamberti*). In western Iowa this is extremely common on the loess bluffs. In some portions, as at Missouri Valley, Crescent and Sioux City the hills are purple with its bloom during the month of May.

*Description*.—This species is a nearly acaulescent perennial with tufts of very numerous short stems coming from a hard and thick rootstock containing many scaly stipules, the stems and leaves are covered with silky and fine appressed hairs; leaves pinnate; leaflets linear; scape-like peduncles, bearing rather large purple, violet, or sometimes white flowers.

*Distribution*.—From Saskatchewan through western Minnesota, western Iowa along the loess bluffs through western Missouri to Texas, common in the Rocky Mountain region, especially from 5,000 to 8,000 feet. The writer has seen this plant abundant in northern Colorado, also in western and northern Wyoming and northeastern Utah.

No reports of poisoning from this weed have been received by the writer from western Iowa, but Chestnut and Wilcox, and





Figure 99. PURPLE OR STEMLESS LOCO WEED (*Oxytropis Lumbertii*.)  
(Chestnut, Division of Bot., U. S. Dept. of Agriculture.)

many other writers refer to its poisonous nature. In regard to the symptoms of poisoning Prof. Chestnut says they are identical with those produced by the woolly loco weed (*Astragalus mollissimus*) and are as follows: "Horses, cattle and sheep are affected by loco, but the principal damage is done to horses. The effect is not acute, but in its slow progress simulates diseases caused by bacteria, worms, or other parasites, or morphine. Two stages are recognized. The first, which may last several months, is a period of hallucination or mania accompanied by defective eyesight, during which the animal may perform all sorts of antics. After acquiring a taste for the plant it refuses every other kind of food, and the second stage is ushered in. This is a linger-

Chestnut, V. K. and Wilcox, E. V. Stock-Poisoning Plants of Montana. Bull. U. S. Dept. Agri., Div. of Bot. 26.

Chestnut, V. K. Thirty Poisonous Plants. U. S. Dept. Agri., Farmer's Bull. 86: 16.



ing period of emaciation, characterized by sunken eyeballs, lusterless hair, and feeble movements. The animal dies as if from starvation, in periods ranging from a few months to one or two years.

Chestnut and Wilcox state that in Montana the chief poisoning arises from *Oxytropis spicatus* and they note these characteristics of animals that are locoed by this weed.

It is the universal experience of sheep raisers that locoed sheep are exceedingly difficult to herd. The sheep may, without a moment's warning, stray away from the band, each one in a different direction and it is easy to understand how nearly impossible it is to prevent such a band of sheep from becoming separated. Besides giving the herder much trouble in directing the course of the band on the range locoed sheep often refuse to enter the corral at night, and under all circumstances may suddenly manifest perplexing stubbornness.

Few cases of locoed cattle have come under our observation. The symptoms, however, in cattle are essentially the same as in sheep and horses. Occasionally locoed cattle manifest dangerous symptoms and attack man or animals. It is difficult to understand why the loco habit is apparently rare in cattle as compared with sheep and horses. In their ordinary feeding habits cattle can hardly be said to be as fastidious in selecting forage plants as horses. The fact remains, however, that cattle do not acquire the habit of eating loco weeds to any great extent.

*Remedies.*—The recommendation concerning locoed animals which is most in accord with reason and the experience of practical stockmen is to remove immediately all locoed animals from contact with other animals. Following this action it would seem to be advisable, when possible, to place such animals on ranges where the loco weeds do not grow and allow them to remain in such situations until winter. During the winter locoed sheep should be fed upon a nutritious diet, and such of them as become fat should be sold for mutton at the conclusion of the feeding period. The few sheep which do not respond to this treatment may as well be killed and skinned, as their only value is that of the pelt. In the case of horses which are kept away from the loco weed for a considerable length of time, the value of the animal is a very uncertain quantity. Such horses may return to the habit of eating loco weeds at the first opportunity, and even if prevented for a time they may develop vicious habits, as already stated. A small percentage of locoed horses apparently make a complete recovery and develop into valuable and reliable animals.

*Extermination.*—This weed though a perennial is easily exterminated by thorough cultivation and plowing. So far as the writer knows this weed is not troublesome in any of the grain and corn fields in western Iowa.

#### RATTLE BOX.—(*Crotalaria sagittalis*, L.)

*Description.*—A hairy annual from three inches to a foot high, with a small tap root. Stem branched, villous, terete or wing



margined. Leaves oval or oblong lanceolate, from one-half to one-third of an inch wide. Edge of the leaf entire or somewhat wavy and hairy. Stipules united and decurrent on the stem, becoming inversely arrow shaped. Peduncles produce a few yellow flowers about one-fourth of an inch in diameter; calyx five cleft, standard of the flower large, heart shaped; keel scythe shaped. Stamens monadelphous, anthers of two sizes, five smaller and roundish. Pod large, inflated, bears a close resemblance to the garden pea, greenish at first, becoming blackish. The pods vary in size from three-fourths of an inch to an inch in length and are about one inch in diameter. Seeds from one-tenth to one-twelfth of an inch in diameter, flattish, kidney shaped. When mature they break away from the point of attachment and rattle in the pod, hence the name "rattle-box."



Figure 100. RATTLE BOX (*Crotalaria sagittalis*). Common in the Missouri River bottom. Causes a disease known as crotalism. (Chestnut, Division of Bot., U. S. Dept. of Agriculture).



*Distribution.*—The plant is common in sandy soil from Maine to Minnesota, South Dakota, Iowa, Nebraska to northern Texas. The plant is extremely common on the sand bars of the Missouri river where it may be collected by the wagon load.

*Poisonous Nature.*—Several letters received last year by the botanical department referred to the injurious nature of the plant. The earliest mention of the poisonous nature of the weed was made by Drs. Salker and Bessey to which I have referred under the head of Loco Poisoning. The symptoms of the disease have been described under that head and need not be treated again. All suspected fields should be examined and the material destroyed.

*Extermination.*—Fields where this plant occurs should be cul-

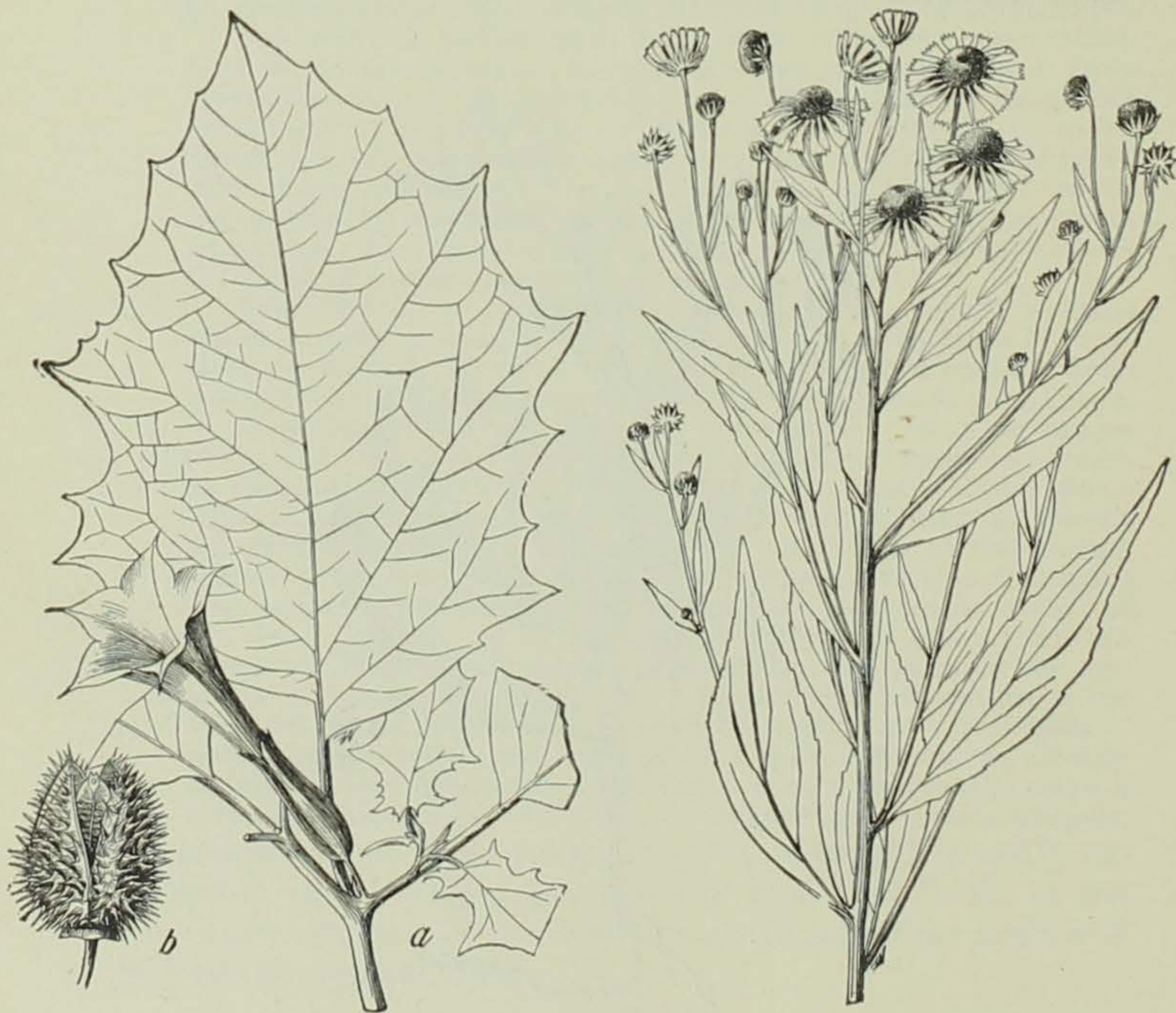


Figure 101. JIMSON WEED (*Datura*). A widely distributed weed common in waste places, farm yards, etc. Belongs to the potato family. (Chestnut, Division of Bot., U. S. Dept. of Agriculture.)  
 Figure 102. SNEEZE WEED (*Helenium autumnale*). A member of the sunflower family. Flowers in the autumn. (Chestnut Division of Bot., U. S. Dept. of Agriculture.)

Bull. Dept. Ia. Agrl. Coll. 1884: 111, 114.



tivated with corn, potatoes or other hoed crops.

JIMSON WEEDS.—(*Datura Stramonium* and *D. Tatula*, L.)

The order Solanaceae is known to have a good many poisonous plants, among them we may mention the black henbane (*Hyoscyamus niger*), and tobacco (*Nicotiana Tabacum*). But two plants widely distributed and frequently suspected of poisoning cattle, as well as persons, are the jimson weeds (*Datura Stramonium* and *D. Tatula*.)

*Description*.—*D. Tatula* is a glabrous annual from a few feet to five feet high; stem purplish; leaves thin, ovate, acute or acuminate; flowers consisting of a five-toothed calyx with a five-lobed funnel form corolla, with stamens included, filiform filaments inserted below the middle of the corolla tube; capsule globular, prickly, four valved and two celled.

*Datura Stramonium* is nearly like *D. Tatula* except that the stem is greenish and less pubescent, and has white flowers.

*Distribution*.—The *D. Tatula* is naturalized in waste places from Ontario to the Dakotas, Nebraska and south to Florida and Texas; naturalized from tropical America. The *D. Stramonium* has about the same range, naturalized from Asia.

*Poisoning*.—A few years ago there was reported in Clinton county a case of poisoning attributed to the seed of the jimson weed. I was unable to get detailed information on the subject but from the newspaper account it seemed to me that the physician made out a pretty good case. The poisonous alkaloids found in the jimson weed are atropine and hyoscyamine, the active constituents of belladonna. The following cases of poisoning are reported by Mr. Chestnut.

Several cases of this kind were reported to the Department during the fall of 1897. At Alpena, Mich., five children were badly poisoned in August by eating the seeds of the purple-flowered species, which was cultivated in a garden as a curiosity under the fanciful trade name of "Night-blooming Cactus." In September a boy was killed in New York by eating the seeds of the jimson weed, which was permitted to grow in a vacant lot; his brother poisoned at the same time was saved only with difficulty. In October two other cases occurred in New York. Four children were playing in one of the public parks of the city where jimson weeds were growing luxuriantly. The boys imagined themselves Indians and roamed about and ate parts of the various plants. Three of them ate the seeds of the jimson weed. One died in a state of wild delirium; another was saved after heroic treatment with chloral hydrate and morphine; the third, who ate but a few seeds, was but little affected. Children are also



poisoned by sucking the flower, or playing with it in the mouth. The fresh green leaves and also the roots have occasionally been cooked by mistake for other wild edible plants. One or two instances are recorded in which cattle have been poisoned by eating the leaves of young plants which were present in grass hay, but these animals generally either avoid the plant or are very resistant to its poison.

The symptoms of poisoning as given by Mr. Chestnut are the following:

The symptoms of the poisoning are about the same in all cases, those characteristic of large doses being headache, vertigo, nausea, extreme thirst, dry, burning skin, and general nervous confusion, with dilated pupils, loss of sight and of voluntary motion, and sometimes mania, convulsions, and death. In smaller amounts the effects are like those of the ordinary narcotics. As vomiting is not a common symptom, the contents of the stomach must be quickly removed by the use of the stomach tube or emetics.

*Extermination.*—The plant has a wonderful capacity for reproduction but it is comparatively easy to destroy the weed by cutting it off. Therefore the treatment should be the same as for any other annual.

#### SNEEZE WEED.—(*Helenium autumnale*, L.)

In many parts of the state the sneeze weed is common and occasionally reports have been received of its poisonous character, especially to sheep. The plant grows in low alluvial bottoms and in many parts of Iowa is very abundant.

*Description.*—A smooth angular branching perennial, from one to five feet high; leaves mostly toothed, lanceolate ovate oblong; heads yellow, appearing in autumn; the involucre of the head or flower consists of small reflexed scales; ray flowers yellow and fertile; disc flowers yellow and fertile; seeds (achenes) top-shaped and ribbed; pappus consisting of five to eight thin and one-nerved chaffy scales.

*Poisonous Nature.*—The plant is more or less bitter, acrid and pungent, especially the flowers. Parts of the plant rubbed were used by the Winnebago Indians for colds and to produce sneezing. As we have said before we have received reports of its poisonous nature to sheep from southern Iowa.

Mr. Chestnut says:

Sheep, cattle, and horses that are unfamiliar with the plant are often poisoned by it when driven to localities where it is abundant. As a rule these animals avoid it, but it is said that they sometimes develop a taste for it and are quickly killed by



eating it in large quantity. The poisonous constituent has not been closely investigated, but it is known that it exists principally in the flowers. The young plants appear to be only very slightly dangerous. In the mature ones the amount of poison present seems to vary greatly even in the same field. The symptoms, as determined by experiments made in Mississippi upon calves, are an accelerated pulse, difficult breathing, staggering, and extreme sensitiveness to the touch. In fatal cases, death is preceded by spasms and convulsions. Melted lard has been used with good effect in offsetting the action of the poison when given before the spasms began.

The sneeze weeds are said sometimes to taint milk, imparting to it a bitter flavor. This is said to be true especially of a species native to Texas but widely introduced in the eastern gulf states and known as the bitter weed, *H. tenuifolium*. Mr. Chestnut likewise reports an instance where the seed of this species found in the bread was supposed to cause the poisoning of several individuals. Occasionally it also produced bitter meat.

*Extermination.*—This weed although a perennial is easily exterminated by thorough cultivation. Certainly there ought to be no trouble from its poisonous nature if cut down a month or so before the plant comes into flower.

Mr. James F. Farrell, of Belfast, Iowa, sent the following communication to the Homestead which was referred to the writer:

Mr. Editor: I send you a sample of a weed that grows abundantly in my pasture along the low rich land of the little creeks. It is known here by the name of "sneeze weed." I once lost a fine three-year-old colt from eating it. If sheep eat it they seldom recover. They generally froth at the mouth, strike their heads against the ground, kick, and seem in greatest misery. My colt acted much the same way. I think it prevails on every farm in this part of the state. One of my neighbors lost three colts last year which he believes to have been poisoned. I believe that the poison was nothing else than the sneeze weed that abounds in his pastures. Some years since a young man in this neighborhood drank tea made of it, mistaking it for Spanish needle, and died with symptoms similar to those of my colt. Please give us what information you can on the subject.

To which the writer at that time replied as follows:

The specimen sent me is sneeze weed, *Helenium autumnale*, a nearly smooth perennial herb from two to six feet high. It is extremely common in low grounds in the Mississippi valley, also occurring from Connecticut to Texas. All the members of this genus are American and contain bitter aromatic principles. This common sneeze weed was once used in medicine, but it is not used extensively at present. Dr. Phares, at one time veterinarian of the Mississippi Agricultural College, says about this weed: "But the *Helenium autumnale* does injure and kill some of our domestic animals." Here is an experiment made by the doctor: "Calf about four months old and not fed in the morning. Upon three ounces of the dried plant was poured a pint of boiling



water. After an hour the water was decanted with pressure. Mr. J. W. McWilliams, of the senior class, gave all the doses in all the experiments and noted all the symptoms. October 6th the above infusion was ordered to be divided into four parts and one part given every half hour, beginning at 11:10 a. m. The first dose produced no marked effect—only a flow of a few tears. After the second dose, became restless, laid down. After third dose produced no marked effect—only a flow of a few tears, sicker for a short while. Fourth dose—breathing harder, but at 3 p. m. the calf was resting easy. Next day he seemed to be as well as usual and took his feed.

The same writer asserts that the horse and mule are affected worse than other animals, sometimes dying.

It remains to be shown whether the experiments by Dr. Phares can be confirmed by others. The plant will not hold its own in cultivated fields. Cutting it off repeatedly during the summer will remove it. Do not allow it to form leaves. Frequent mowing ought surely to be a relief.

The subject is worthy a more full and complete investigation than has heretofore been given it. Until that has been given every farmer who has this pest growing on his farm should see that it is cut down as often as it appears. Persistent cultivation will kill most any kind of a weed. It will give but little if any trouble except in permanent pastures.

The Rocky Mountain *Helenium Hoopesii* is common in the mountain districts of the Uintahs. Though sheep commonly eat many of the plants of the region, this weed is carefully avoided, probably because of the bitter principles it contains.

#### A FEW OTHER POISONOUS PLANTS.

Many other plants in the state of Iowa are poisonous or have been suspected of being poisonous. One of the most common of these in the northern and western part of the state is the pasque flower, very commonly referred to as the crocus (*Anemone Patens*, var. *Nuttalliana*). This flower produces six sepals, purplish or whitish in color, about 1½ inches long, coming from a simple erect stem, naked except the involucre. The leaves are ternately divided with the lateral divisions two parted.

An allied European species, European *Anemone Pulsatilla*, is regarded as poisonous. The different parts of the plant are extremely acrid and when applied to the skin cause irritation and dessication. The acidity of the plant is due to the presence of



a crystalline substance called anemonin  
Johnson says:



Figure 103. POISON IVY (*Rhus Toxicodendron*). (Chestnut, Division of Bot., U. S. Dept. of Agriculture.)

Figure 104. CORN COCKLE (*Lychnis Githago*). Common in screenings of wheat considered poisonous. (Chestnut Division of Bot., U. S. Dept. of Agriculture).

Pulsatilla is an active irritant which in large doses has often produced serious and alarming effects.

An allied plant, the marsh marigold or cowslip (*Caltha palustris*), is also regarded as poisonous in Europe. In this country, however, it is frequently used for greens as a pot herb.

Coville says:

By many it is considered superior to any other plant used in this way. There is no doubt that boiling dissipates the active principles found in the plant.

It is a stout glabrous perennial with a hollow stem from one to two feet high, the basal leaves on long and broad petioles.

A Manual of Botany of North America. 60.

Yearbook U. S. Dept. Agrl. 1895: 211.





Figure 105. The right hand figure LOCO WEED (*Oxytropis Lambertii*). The left hand figure *Rue Anemone*. Some plants of this order, the crowfoot family, poisonous. (Courtesy Iowa Hort. Society.)



Leaves uniform. The upper leaves are shorter, petioled and sessile. Flowers with yellow sepals. Occurs in swamps and meadows. Common only in northern and northeastern Iowa. Another plant somewhat acrid is the *Isopyrum* which is shown on plate with stemless loco weed.

### POISON IVY.

Poison ivy (*Rhus Toxicodendron*) is common everywhere in the state, especially in woods. It goes under the name of poison creeper, three-leaved ivy, or more frequently as poison ivy. It



Figure 106. PASQUE FLOWER (*Anemone Patens* var *Nuttalliana*). A poisonous weed of northern Iowa. (Johnson).

is a climbing or trailing shrub, sometimes erect, with three leaflets. The aerial rootlets enable the plant to cling to trees or other objects. The flowers are inconspicuous, fruit is waxy, and frequently remains on the plant until late winter or early spring.



The leaves somewhat resemble those of the box elder but they are larger, and there is some resemblance also to the Virginia creeper, for which it is often mistaken. The leaflets of the box elder are pinnately compound with five leaflets. Those of the Virginia creeper are palmately compound with five leaflets.



Figure 107. WILD CHERRY (*Prunus serotina*). Poisonous to stock. (Chestnut U. S. Dept. of Agriculture).

Many persons are quite sensitive to its poisoning. Others may touch it with impunity. Dr. Pfaff of Harvard University Medical School discovered an oil several years ago which he called toxicodendrol. The remedy for it is to wash the skin with sugar of lead.

#### WEED MIGRATION.

Every one who has observed plants knows that they migrate as truly as do animals. It is only in some of the lowest forms



that the organism is so constituted that it can migrate of its own accord. In the plants that we are here dealing with they are generally fixed to some substratum and thus can not move from place to place except the seeds or fruits or when by vegetative reproduction parts of the plant are carried away. All plants have moved from place to place; they have found new abodes for their development. Plants are checked in their migrations because of barriers against their spread; such barriers are mountain chains and large bodies of water, soil and unsuitable climate. The latter is a most important factor. Vanilla grass (*Hierochloa borealis*) is said to be a troublesome weed in the Canadian wheat fields, though not infrequent in Minnesota, and found here and there in low swampy places of northern Iowa it is not suited to Iowa climate and will never become a troublesome weed. Nor will any of the numerous alpine plants of the Rocky Mountains ever become weedy in Iowa, because of the unsuitableness of our climate. The Russian thistle (*Salsola kali* var. *Traque*) is a good illustration of a plant native to the great steppes of Russia with a climate not unlike that of our western plains, that has found here conditions suitable to its perfect development and hence it has spread with extraordinary rapidity in northwestern Iowa, the Dakotas, Nebraska and westward. Soil influences plant migration to some extent. Our northern nut grass (*Cyperus esculentus*) though abundant in low places in our cultivated fields never becomes a serious pest in the higher drained soils. Sand bur (*Cenchrus tribuloides*) is most troublesome in the dry sandy soils of the flood plains of streams, the more fertile soils are barriers against its spread, though in this case as in some others there is some adaptation to changed conditions. The annuals seem to have a better chance to adapt themselves than perennials or biennials for the reason that nearly all weeds are herbaceous, yet a few are woody. In Iowa and other western states the sumach (*Rhus glabra*) is occasionally persistent. In the south, woody plants, as weeds are much more frequent. In 1888 I had occasion to investigate a cotton disease for the Texas agricultural experiment station, and this frequently brought me in fields. I thus had an excellent opportunity of making some observations on the weeds of Texas. In the rich and fertile bottoms of the Brazos, a native species of grape (*Vitis arborea*) thickly covers the ground, making it very difficult to cultivate. The pecan persists for some time after the ground has been brought under cultivation. In the great American bottom opposite St. Louis.



the persimmon often is very annoying. In many tropical countries the weedy woody plants soon cover the ground if not kept down.

*Origin of weeds.*—Our Iowa weeds are in large part native to Europe, but there are a number native to Iowa, while others have come from the south and west. The question of migration of weeds is an interesting one. In the east the European weeds

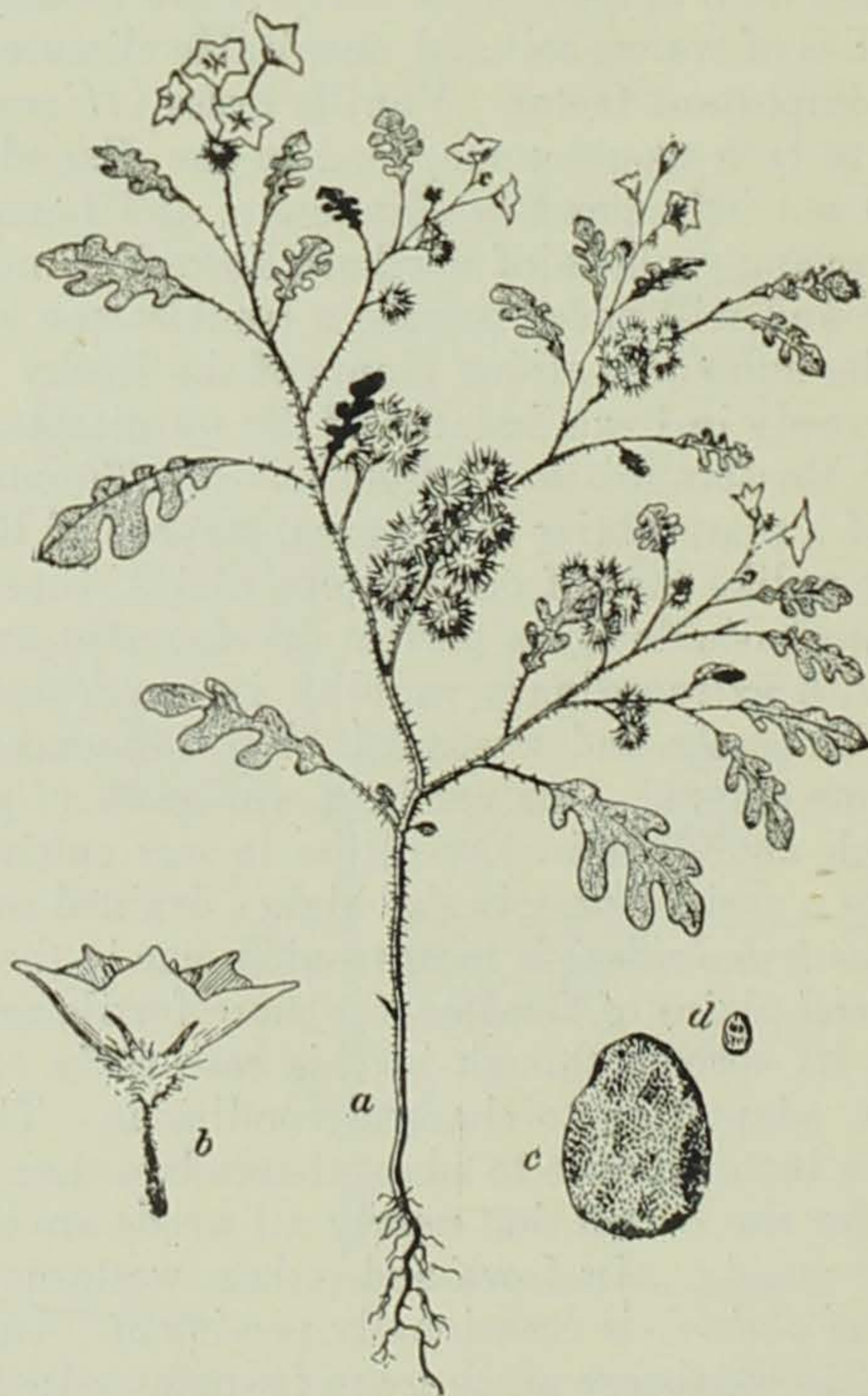


Figure 108. BUFFALO BUR (*Solanum rostratum*). A weed of prairie dog mounds and buffalo wallows of the west. Now widely scattered in the southern states and east of the Mississippi. (Dewey Div. of Bot. U. S. Dept. of Agriculture).

predominate. In the southwest and the prairie states west of the Missouri most of the troublesome weeds are indigenous to the soil. I cannot recall a single very troublesome weed in Texas that has come from Europe; they are either of tropical origin or else indigenous. Dr. Gray has somewhere said that most of the troublesome weeds of west Europe have originated in the east. It



is certainly true that as conditions are prepared weeds spring into existence. Such plants as are best adapted to stand adverse conditions assert themselves and become the pests of the farmer. Certain weeds are cosmopolitan. Purslane is found in all parts of the civilized world. Dr. Halsted who has looked up the matter of weeds in the United States, finds cocklebur (*Xanthium Canadense*), rib grass (*Plantago lanceolata*), goose foot (*Chenopodium album*), common from Maine to California, a species of barley (*Hordeum murinum*) and mallow (*Malva borealis*), are peculiar to the Pacific Coast and intermountain country.

Spiny nightshade (*Solanum rostratum*) and common sunflower (*Helianthus annuus*) are prairie weeds west of the Missouri river. The south and southwest have a sneeze weed (*Helenium tenuifolium*). In the east, the Canadian thistle (*Cnicus*



Figure 109. BIND WEED OR MORNING GLORY (*Convolvulus arvensis*). This European weed introduced from Europe cultivated first as an ornamental plant has become widely scattered in the Mississippi Valley and eastern states. (Charlotte M. King).



*arvensis*), and ox-eye daisy (*Chrysanthemum leucanthemum*) head the list of the troublesome weeds.

It does not require much botanical knowledge to recognize the similarity of the flora of our "great plains." Many of the prairie plants are common from Texas to Manitoba. The Compass Plant (*Silphium laciniatum*), buffalo bur (*Solanum rostratum*), common sunflower (*Helianthus annuus*), etc., are alike common to the prairies of Texas, Kansas, Nebraska and the Dakotas.

It is remarkable how rapidly European weeds have spread in parts of South America. In the neighborhood of Buenos Ayres, hair clover (*Medicago denticulata*), a composite (*Silybum marianum*), which has become noted as a pest in California, *Cynara*



Figure 110. BLACK MUSTARD (*Brassica nigra*). A weed of grain fields widely scattered in grain and flax fields in the northern states. The weed is a native to Europe. (Dewey Div. of Bot. U. S. Dept. of Agriculture).

*cardunculus* cover the pampas for miles. The European grasses, like perennial rye grass (*Lolium perenne*), Squirrel grass (*Hordeum murinum*) and other wild barleys (*H. pratense*) have rapidly taken the place of native grasses. The interesting observation





Figure 111. CRAB GRASS (*Panicum sanguinale*). One of the European weedy grasses now cosmopolitan. (Scribner Div. of Agr. U. S. Dept. of Agriculture).

has been made in South America and Australia, that indigenous (native) species have been crowded out by closely related European species. In Australia common sow thistle (*Sonchus oleraceus*), a truly cosmopolitan weed, has established itself in low grounds near streams and has crowded out a native species of *Sonchus*. It is possible that some of our native plants are affected in this way. Common purslane (*Portulaca oleracea*) has without doubt in some places replaced native forms. Bull thistle (*Cnicus lanceolatus*) undoubtedly trespasses on the ground of some of our native species. *C. altissimus*, *C. Iowensis* and *C. discolor* are undoubtedly affected in this way. These thistles are





Figure 112. HORSEWEED (*Erigeron Canadensis*). A widely distributed native North American weed, which has established itself in Europe. (Charlotte M. King.)

certainly less abundant where bull thistle occurs. Another illustration of the crowding out of useful plants is found in wire grass (*Poa compressa*). This grass occasionally makes its appearance in blue grass pastures and lawns, where it forms a dense mat, and in some cases crowding out its more valuable relative. Finger grass (*Panicum glabrum*) is a veritable nuisance in lawns in Des Moines, Boone and other towns of Iowa, St. Louis, Missouri, and Madison, Wis. It is sometimes said that most of our weeds are of European origin. This is true only for certain parts of



the United States, notably so in New York, Massachusetts, Ohio, Illinois, and other states that belong to the North Atlantic section. Yet the weeds of the interior region, the territory embracing our prairies, has a surprising number of native plants that are weedy in their nature. A few of the European weeds are, however, great pests. Tumble weeds (*Cycloloma platyphyllum*) and (*Corispermum hyssopifolium*). Ragweed (*Ambrosia trifida*) may be mentioned among the troublesome weeds of the west. The preponderance of these weeds is possibly due to the newness of the country, or it may be because of the plasticity of the plants themselves or certain climatic conditions. In southern Atlantic states we note is a surprising number of weeds that are of tropical origin. The Spiny Amaranth (*Amarantus spinosus*), Mexican tea (*Chenopodium ambrosioides*), Senna (*Cassia occidentalis*), common morning glory (*Ipomoea purpurea*) and *I. hederacea*. Quite a number have come from India, as jimson weed (*Datura Stramonium*), heliotrope (*Heliotropium indicum*), etc. Some are European also.

Turning to the weeds of the Pacific coast, it may be said that its weed flora is entirely different. Dr. Hilgard, in an interesting series of articles, "The Weeds of California" in Garden and Forest, says:

The broad fact in the premises that first strikes the new comer in California is that a number of plants that are the subjects of careful culture east of the Rocky Mountains, as well as in Europe, and which quickly succumb when deprived of artificial protection there, are here among the most persistent and obnoxious weeds; while very many of those that troublesome in the Atlantic region are conspicuously absent on the Pacific side. Radish, beet, celery, carrot, are conspicuous weeds. The smart weeds (*Polygonum*) are always entirely absent on the Pacific coast. Amaranths flourish. Pusley, so troublesome in eastern states, has only appeared in a few localities. As yet it has made no headway as a troublesome weed. Burr clover (*Medicago denticulata*) so troublesome in South America, is one of the earliest of the European introductions in California, and is a great pest. These illustrations suffice to show the differences in the character of the weed flora in various parts of the United States.

*European and American weeds.*—It may be of interest to compare the weeds of the United States with those of Europe. Some of the common European weeds, it will be noticed, are conspicuous in this country. Canada thistle, common sow thistle (*Son-*



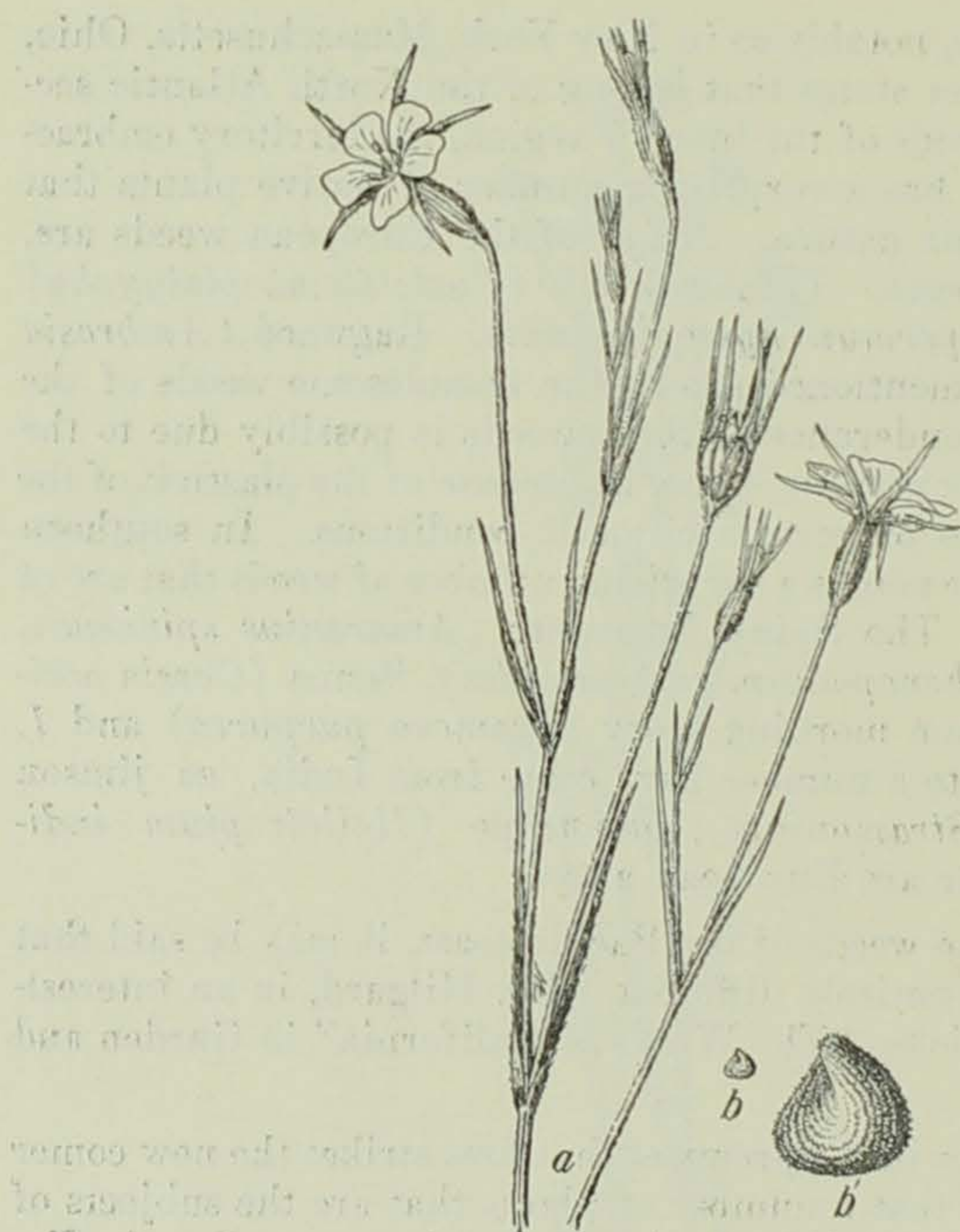


Figure 113. CORN COCKLE (*Lychnis Githago*). A weed of grain fields widely scattered in grain growing sections of the United States and the old world. (Chestnut Div. of Bot. U. S. Dept. of Agriculture).

*chus oleraceus*), cockle (*Lychnis Githago*), mayweed or fennel (*Anthemis Cotula*), hedge bindweed (*Convolvulus sepium*), common smart weed (*Polygonum Persicaria*), horse weed (*Erigeron Canadensis*), meadow saffron (*Colchicum autumnale*), wild oats (*Avena fatua*), chess (*Bromus secalinus*), quack grass (*Agropyron repens*), *Anacharis Canadensis*, evening primrose (*Oenothera biennis*), *Seneio vulgaris*, with a host of weeds of minor importance.

Of the cosmopolitan weeds sheperd's purse (*Capsella Bursa-pastoris*) occurs everywhere in Europe, Persia, India, Japan, United States, Chili, South Africa; pusley occurs in India, Egypt, Europe, South Africa, Japan, China, Java and Philippine Islands; horse weed (*Erigeron Canadensis*), everywhere in the United States from Maine to California, Brazil, South Italy, Moscow, Russia, Sweden, Persia, North India, South Africa.



It is sometimes a very difficult matter to decide whether a plant is strictly native to a country or has been introduced, so thoroughly have they established themselves. Pusley is an excellent illustration. It is believed to be a native to the southwest.

*Lines of travel.*—Weeds in their migration have followed certain well defined lines of travel. The floras of our Atlantic states mention the occurrence of certain weeds commonly found where the ballast material was discharged. The list of ballast plants on the Atlantic and Pacific coast is constantly increasing.

In speaking of the means of transportation of weeds Dewey says that the routes of transportation are indicated by the names, ballast plants, roadside weeds, weeds along the tow path, and railway weeds. Mr. Dewey says: "One hundred and three species were taken in ballast from Buenos Ayres to New Zealand within a period of a few years."

There is no doubt that the Crusaders brought many weeds back from western Asia into Europe. Thus plants like the horseradish (*Nasturtium Armoracia*), mustard (*Brassica Sinapistrum*), hemp (*Cannabis sativa*), are Asiatic plants and Kabsch notes that most of the weeds of cereals like *Centaurea*

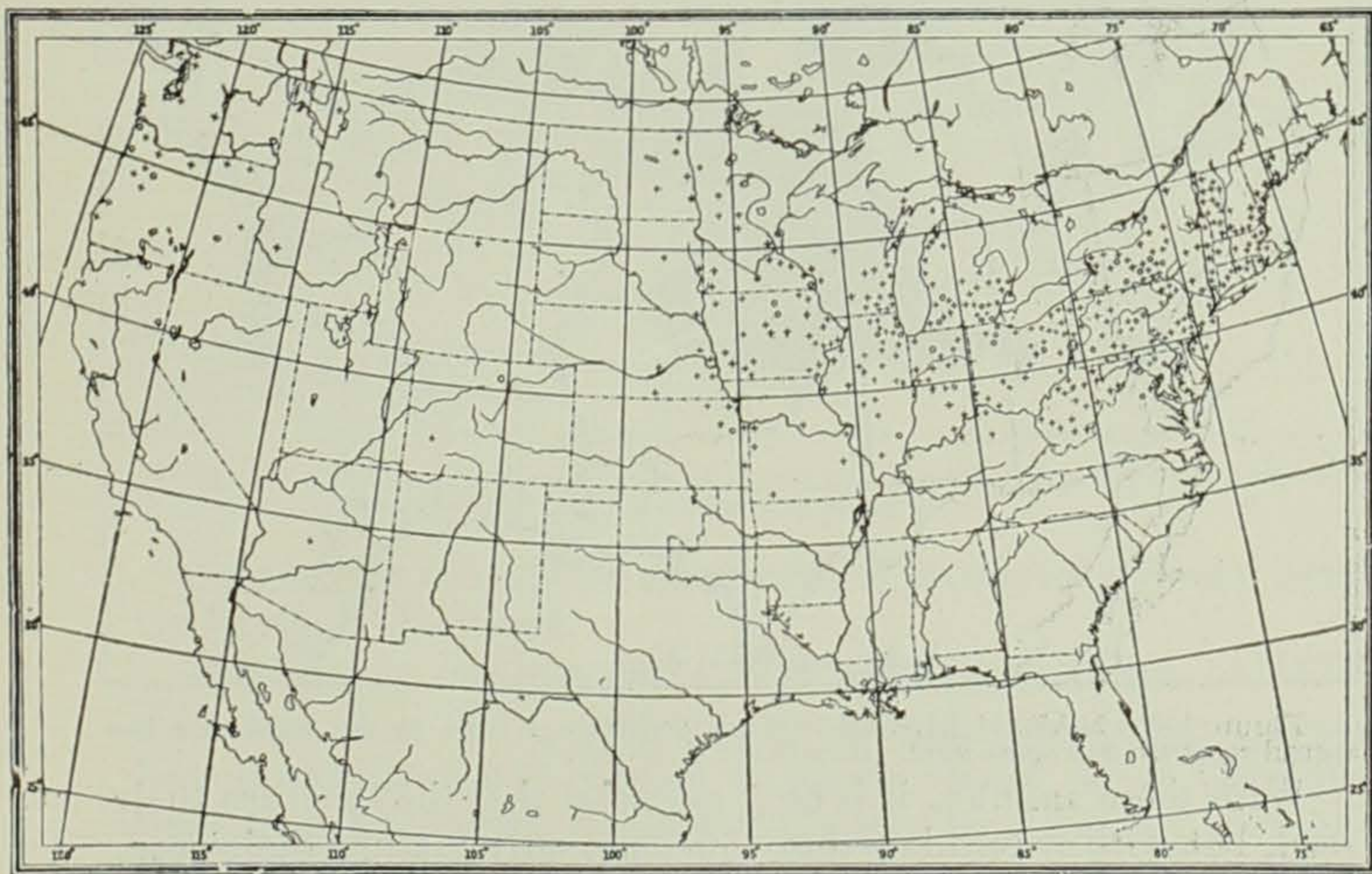


Figure 114. The distribution of the Canada Thistle in the United States. Its adaption to northern United States and Canada plainly shown by its distribution. (Dewey Div. of Bot. U. S. Dept. of Agriculture).



*Cyanus*, *Lychnis Githago*, *Raphanus Raphanistrum* and *Myagrum sativum* are foreign to Europe. But Europe has also received a number of American weeds from us like the *Erigeron Canadensis* the common horse weed. The *Oenothera biennis* became a settler of Padua, Italy, in 1812; the *Erigeron Canadensis* near Paris in 1835. Our common rice cut grass (*Leersia oryzoides*) according to Buchenau made its appearance in Italy as follows:

Of our early weeds reliable information is often wanting. The history of some weeds is well known. Prickly lettuce (*Lactuca Scariola*) made its appearance in eastern Massachusetts in 1863, but is now known in many states of the Union, growing like a native plant. I find notice of this weed by Prof. Arthur in an early catalogue of the flora of Iowa. Either it failed to establish itself or it escaped the notice of botanists. In Europe we have definite information concerning the spreading of some weeds. *Elodea Canadensis*, a most harmless water plant in North America, first appeared in Ireland in 1838; in 1846 it was recorded in Scotland; in 1860 it was observed on the continent; in 1862 it became generally distributed.

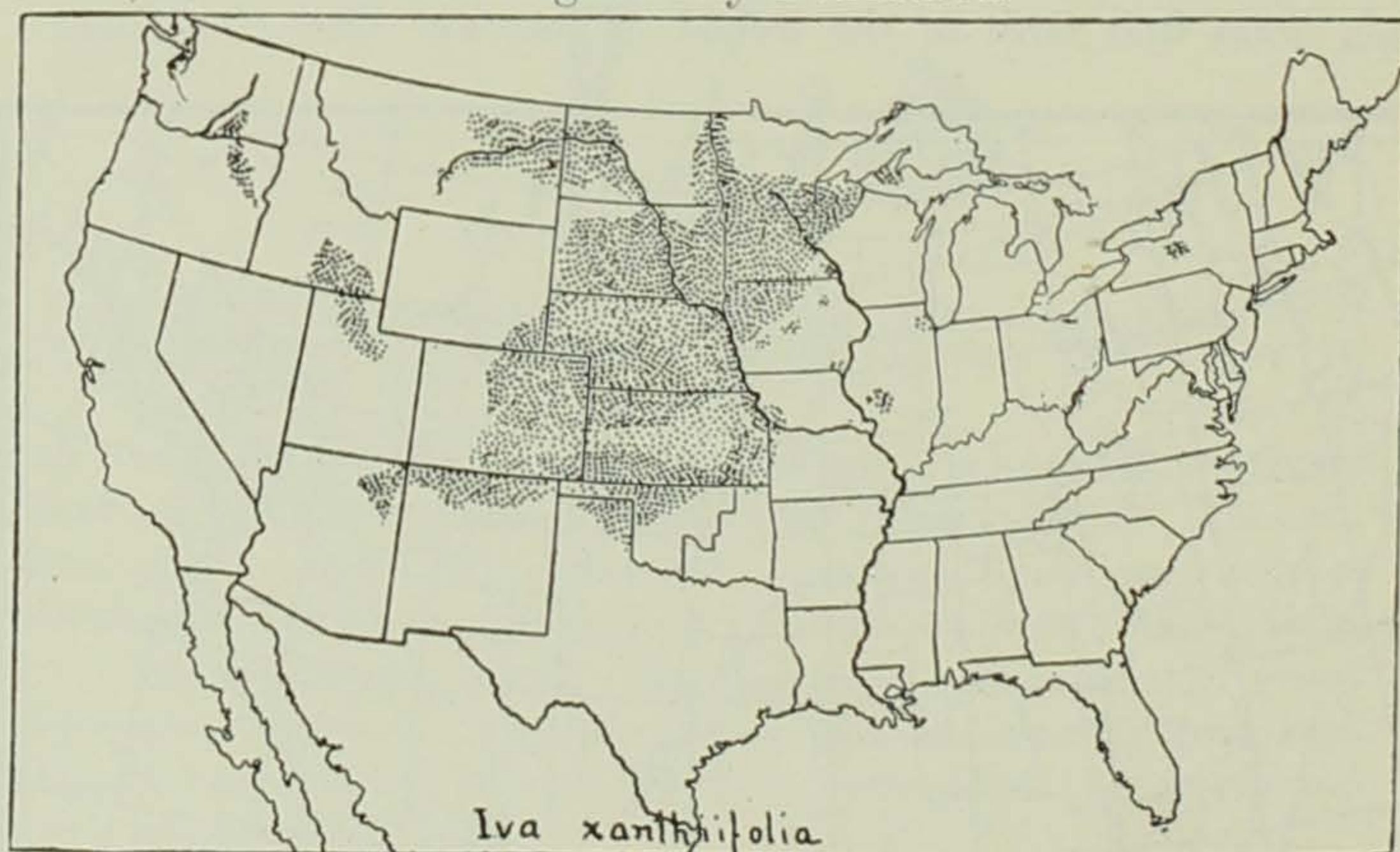


Figure 115. MARSH ELDER (*Iva xanthiifolia*). Native to the northwest has spread eastward and southward. (Charlotte M. King).

With these annuals, it is only essential that they mature their seed, but with perennials they must not only mature their seed, but the plants must be able to survive the winter. Those who

Kabsch. Das Pflanzenleben der Erde. 532.

Buchenau Bot. Zeit. Abt. 2.52: 83, 201.



hold that perennials can not be acclimated will find an exception in *Solanum Carolinense*. Darlington, in his "Flora Cestrica," makes the statement that it was introduced by the late Humphrey Marshall into his botanical garden at Marshalltown. Beck, in 1833, gave its distribution as Pennsylvania to Carolina, west to Mississippi. In the second edition of Gray's Manual, Connecticut is included; it is also included in the fifth edition, and in the "Synoptical Flora" it is said to occur from Connecticut to Illinois and southward. Dr. Eaton, however, writes me that he has not seen it, and there is no record of its occurrence in that state except the specimens found by Dr. Robbins. That the weed is still spreading in West Virginia is indicated by Millspaugh. In 1852 Brendel found it present in Peoria, Illinois. *Solanum Carolinense* also occurs in Wisconsin.



Figure 116. The distribution of three weeds, the Horse Nettle (*Solanum Carolinense*) and the two species of *Tribulus*. (Charlotte M. King).

Generally speaking the movement of weeds in our own country has been westward.

The chicory was introduced near Dorchester, Mass., in 1875, and since then has spread chiefly through the northern states. The ox-eye daisy was carried to Rhode Island about 1815 and since then has spread throughou the northern states. Purslane was cultivated as early as 1672 in Massachusetts and since then has spread to all portions of the United States. Were it not for

Dewey. 1. c. 279.

Dewey. 1. c.



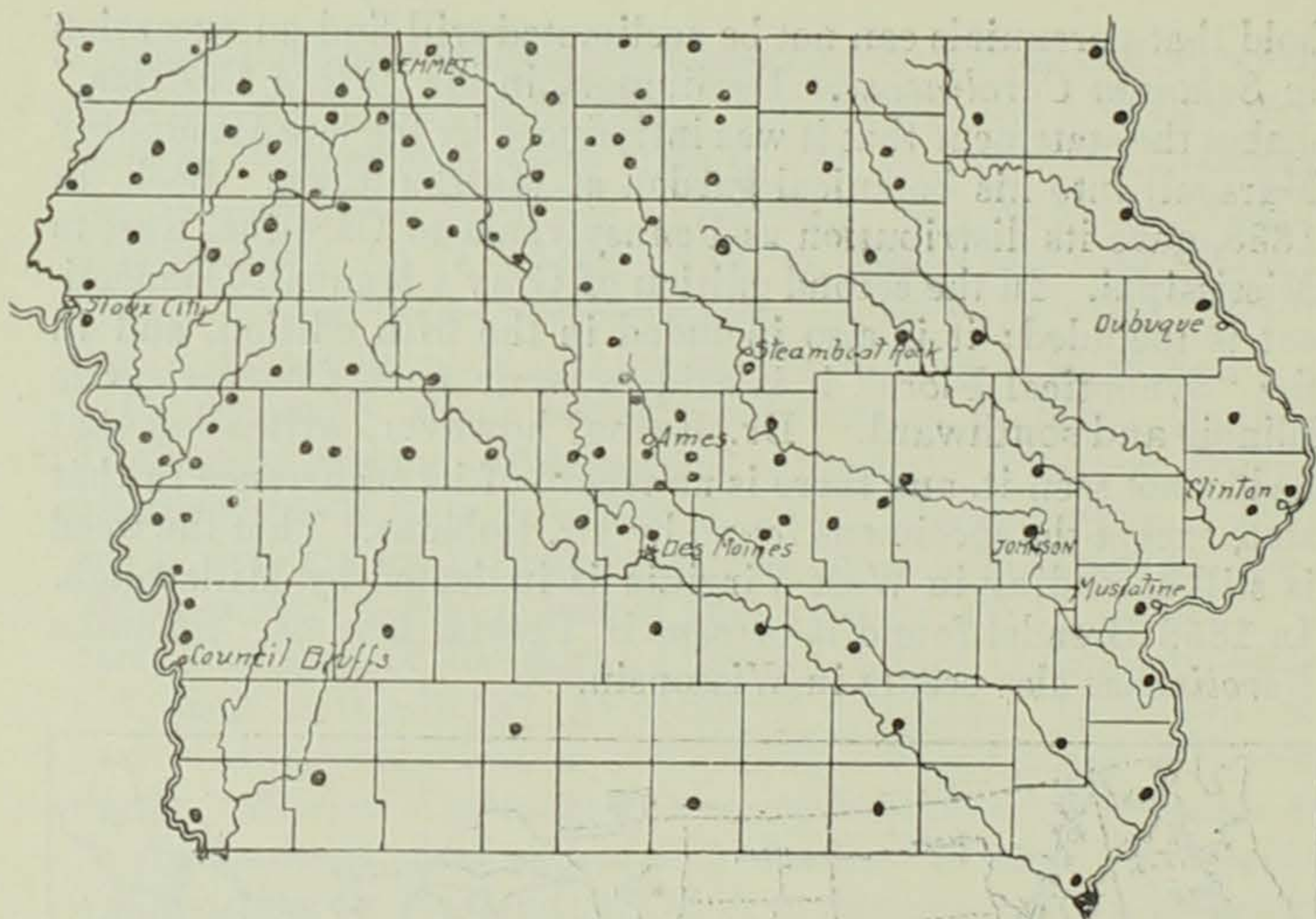


Figure 117. The distribution of Charlock (*Brassica Sinapistrum*) in the state of Iowa. Its abundance shown by the dots in northern and northwestern Iowa where spring wheat and flax are generally grown. (Charlotte M. King).

some of these records it would be quite impossible to say whether a plant was indigenous or native. We have better records of the appearance of later introductions like the golden hawk weed, first found in the eastern states where it has become a troublesome weed and occasionally found now in the western states even in Iowa. While some of these weeds have spread westward some of our western plants have spread eastward. Of these we might cite the Marsh elder. In Gray's Manual, 6th edition, the distribution of this weed is given as follows: Northwest Wisconsin to Minnesota and Kansas westward. It must indeed originally have been quite local in many places in this region. It is only recently that this weed has attracted attention. The accompanying map shows where the weed has been found in this country. Another illustration is buffalo bur. In Gray's "Synoptical Flora," the distribution is given as "Plains of Nebraska to Texas (Mexico)." In Gray's Manual, 6th edition, the statement is made "spreading eastward to Illinois and Tennessee." And Britton, in his manual of botany says, "On prairies, South Dakota to Texas and Mexico. Occasional in waste places as a weed, Ontario to New Hampshire, Massachusetts and New Jersey, adventive from the west." This plant has certainly spread

Britton. Manual of the Flora of the Northern States and Canada. 815.



to many different points in the eastern states.

The *Rudbeckia hirta* is another plant that has spread eastward. Few of the southern plants have spread northward. Among these, however, we may cite the horse nettle (*Solanum Carolinense*). The record of sand brier or horse nettle forms an interesting chapter in the migration of perennial plants from one part of the country to another. It is much easier for an annual to become acclimated than a perennial. Throughout the Mississippi valley there are tropical plants which have become thoroughly naturalized, as in *Amarantus retroflexus*, *A. albus*, *A. spinosus*, *Abutilon Avicennae* and *Sida spinosa*. Within the memory of the present generation Indian Mallow has been naturalized in western Wisconsin; *Argemone Mexicana* in a comparatively short time has found its way into Kansas, Iowa and Illinois; *Cardiospermum Halicacabum* of the southwest is common opposite St. Louis, in Illinois.

## DISSEMINATION.

It is not only important for plants to form seeds so that their kind may be perpetuated but it is of the greatest moment to the plant that its seed be carried away from the place where it was produced. They migrate to improve their condition, to avoid competition. As Dr. Beal says:

"The various devices by which plants are shifted from place to place are not merely to extend and multiply the species, and reach a fertile soil, but to enable them to flee from the greatest number of their kind, and from their enemies among animals and parasitic plants. The adventurers among plants often meet with the best success, not because the seeds are larger, or stronger, or better, but because they find for a time more congenial surroundings."

The scattering of plants is known as dissemination.

Suppose a thistle should drop its thousand of little seeds on the ground surrounding the plant. What would become of them? A small percentage of seed would germinate and only a very small percentage of the young plants would ever become mature and lusty. So with the bouncing betty, the pigeon grass, and many



others. We should not overlook the fact here that the reason for dispersal is to improve the condition of plants, also with reference to cross fertilization.

Professors Hitchcock and Clothier record the number of seeds produced by some weeds as follows:

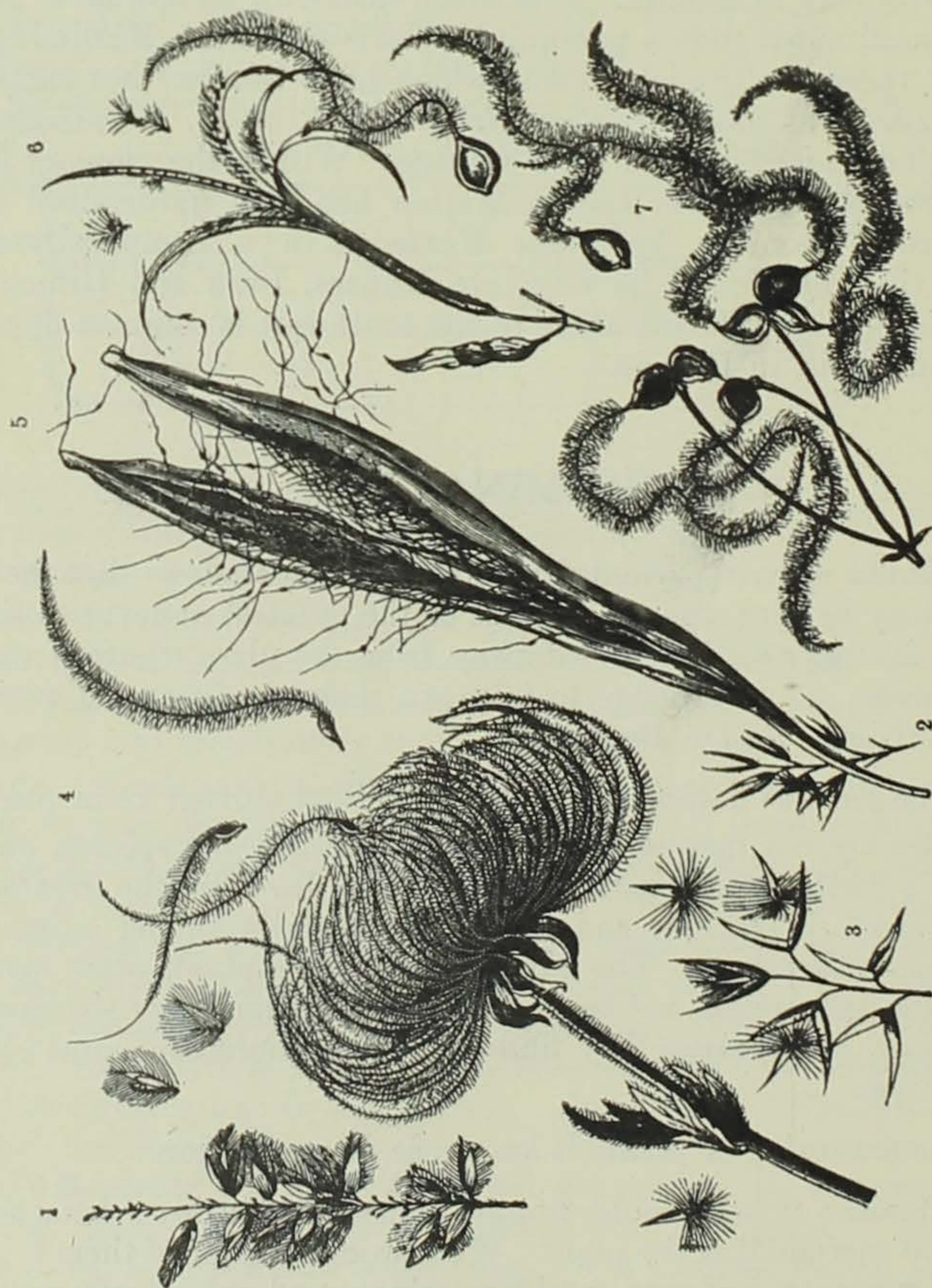


Figure 118. WIND DISSEMINATED FRUITS AND SEEDS. 1, *Melica Balansae*; 2, *Calamagrostis Epigeios*, natural size; 3, same magnified; 4, *Geum montanum*; 5, *Aschynanthus speciosus*; 6, *Epilobium collinum*; 7, *Clematis Flammula*. (Kerner-Oliver).



<i>Portulaca oleracea</i> (Purslane) . . . . .	69,000
<i>Xanthium Canadense</i> (Cockle Bur) . . . . .	9,700
<i>Amarantus retroflexus</i> (Red Root) . . . . .	85,000
<i>Acnida tuberculata</i> (Water Hemp) . . . . .	945,000
<i>Euphorbia marginata</i> (Snow-on-the-Mountain) . . . . .	21,900
<i>Setaria glauca</i> (Yellow Foxtail) . . . . .	113,600
<i>Eragrostis major</i> (Stinking grass) . . . . .	140,000

Mr. Lummis in the laboratory of the botanical department determined the number of seeds found in certain weeds to be as follows:

Name of plant.	No. of seed produced per weed.
<i>Asclepias cornuti</i> . . . . .	1,730 to 2,706
<i>Artemisia Ludoviciana</i> . . . . .	20,790 to 63,340
<i>Acalypha Virginica</i> . . . . .	660
<i>Amarantus retroflexus</i> . . . . .	48,750 to 115,600
<i>Bidens frondosa</i> . . . . .	1,680 to 3,000
<i>Cannabis sativa</i> . . . . .	540 to 1,100
<i>Chenopodium album</i> (from Ottumwa) . . . . .	15,840
<i>Datura Stramonium</i> . . . . .	48,720 to 89,100
<i>Erigeron Canadensis</i> . . . . .	300,000 to 324,000
<i>Plantago major</i> . . . . .	3,600 to 16,500
<i>Polygonum avicularie</i> . . . . .	200 to 600
<i>Panicum capillare</i> . . . . .	7,680 to 58,080
<i>Solidago Canadensis</i> . . . . .	3,530 to 12,320

Dr. Halsted determined the number of seeds found in some seeds as follows:

Name of plant.	Seeds per plant.
Shepherd's Purse ( <i>Capsella Bursa-pastoris</i> ) . . . . .	17,600
Purslane Speedwell ( <i>Veronica peregrina</i> ) . . . . .	186,292
Dandelion ( <i>Taraxacum officinale</i> ) . . . . .	1,729
Marsh Marigold ( <i>Caltha palustris</i> ) . . . . .	630
Yellow Rocket ( <i>Barbarea vulgaris</i> ) . . . . .	24,100
Lousewort ( <i>Pedicularis Canadensis</i> ) . . . . .	600
Pepper Grass ( <i>Lepidum Virginicum</i> ) . . . . .	12,225
Rocket ( <i>Hesperis matronalis</i> ) . . . . .	22,125
Meadow Parsnip ( <i>Thaspium aureum</i> ) . . . . .	1,650
Ox-eye Daisy ( <i>Chrysanthemum Leucanthemum</i> ) . . . . .	6,750
Charlock ( <i>Brassica Sinapistrum</i> ) . . . . .	9,900

Professors Hitchcock and Clothier made some interesting determinations of weeds occupying poor soils, for this purpose ten feet square were marked off in 1893, the seedlings were removed from time to time and recorded. In the year 1894 a similar plat was laid off near the first. The tables are both interesting as showing the enormous number of weeds that made their appearance. The total for five years was 37,639 weeds, 79 different plants making their appearance on this plat. No. 1. Common pusley, an amaranth like plant *Acnida*, stink grass and crab grass were the plants most commonly found.

Bull. Dept. Botany, Ia. Agr. College. 1886: 44.

Kansas Agri. Exp. Sta. Bull. 80: 124.



In plat No. 2, the total number was 70,825 weeds of which the more important weeds were the common pusley, 17,792; also shoo fly, 6,169; buffalo bur 28,303; Heart's ease, (*Polygonum Pennsylvanicum*) 5,121; stink grass, 2,338; evening primrose (*Oenothera biennis*) 1,739.

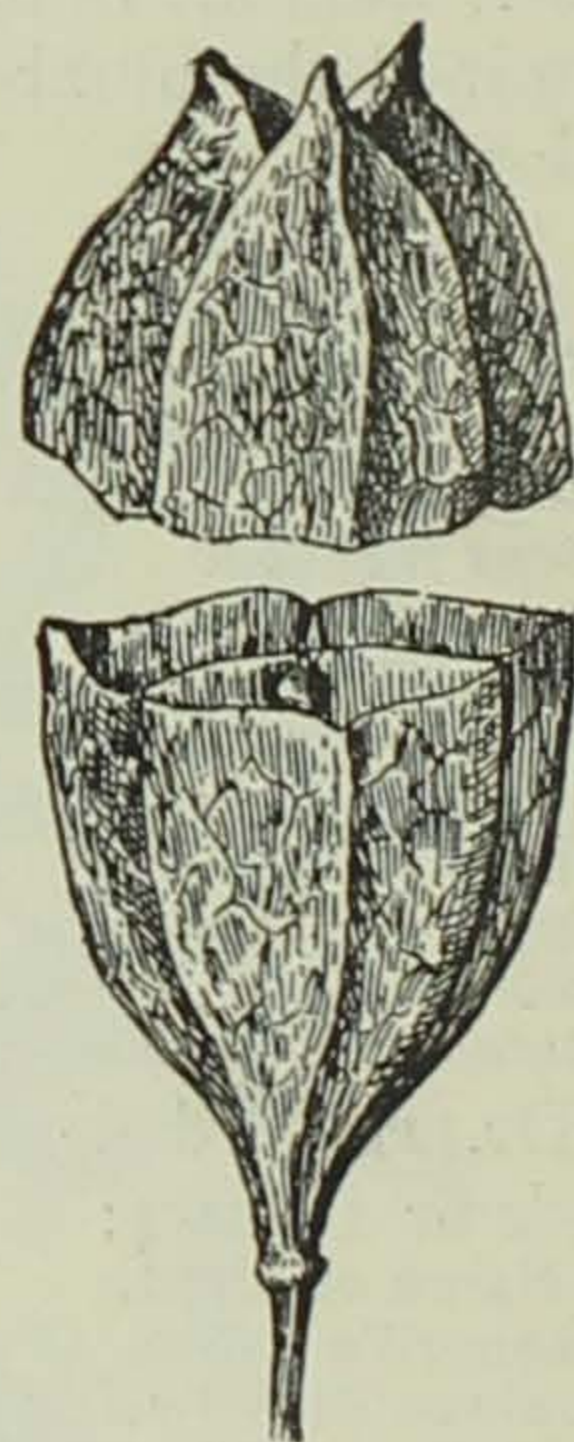
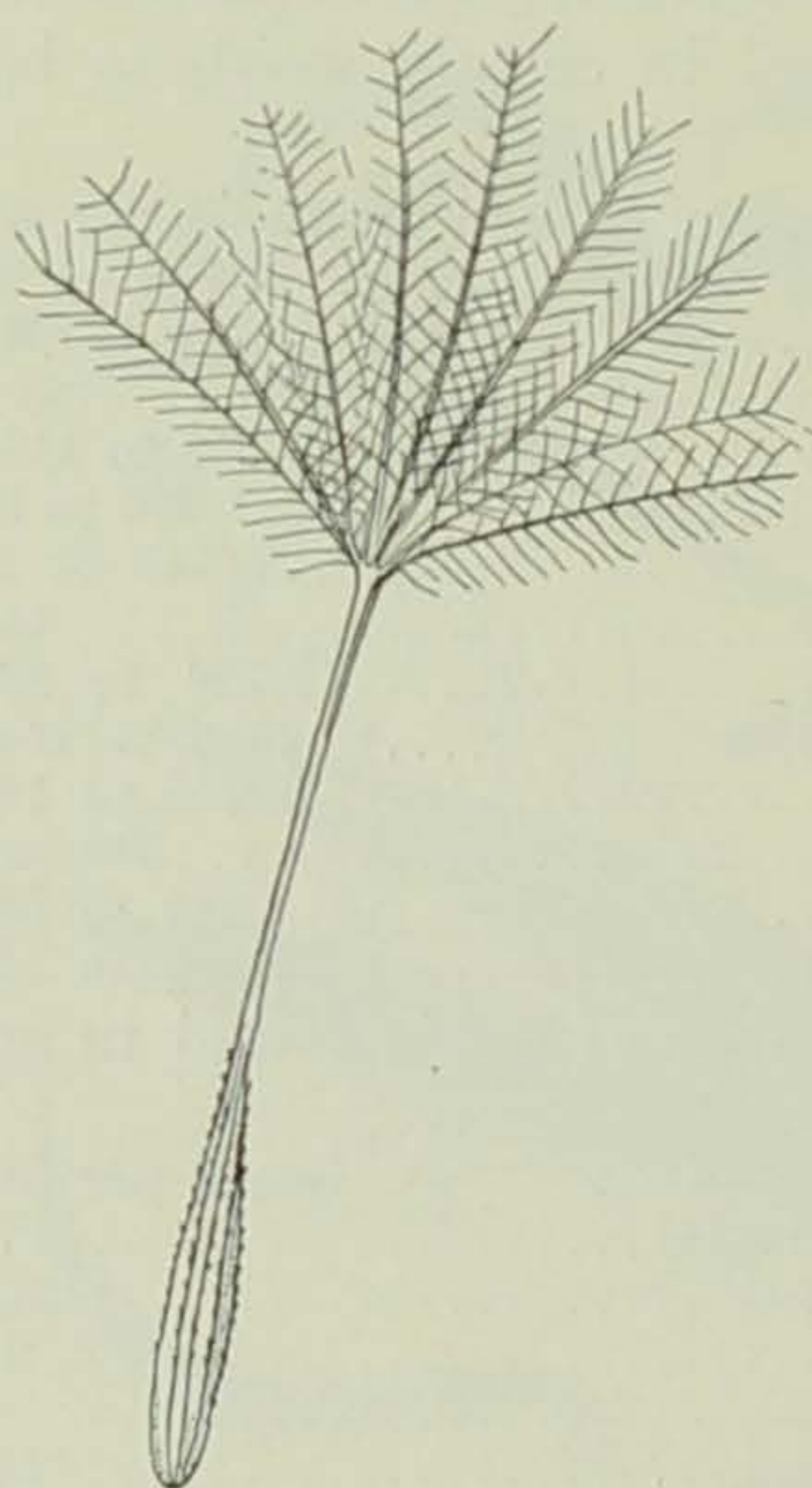


Figure 119. THE VEGETABLE OYSTER (*Tragopogon porrifolias*) disseminated by the wind. (Charlotte M. King.)  
Figure 120. THE BLADDER NUT (*Staphylea trifolia*). Disseminated by the wind and water. (W. J. Beal).

During the present season counts of the number of weeds found on a square rod were made by Mr. H. S. Fawcett. The tables appended show an unusual weedy condition. Comparing table No. II and III will show how many of the weeds are destroyed by plowing once and harrowing twice, the season being a wet one.

#### COUNT OF WEEDS ON A SQUARE ROD OF GRAVEL.

Along railroad track north of college two rods west of road leading under track. Soil, black loam, dry, medium well drained, level. Covered with growth of weeds. Never cultivated. Burned over early in the spring. The common *Setaria* was so small that it was omitted in this count.



May 28, 1903.

Name of Weed:	No. per sq. rod.
Meadow Rose ( <i>Rosa blanda</i> var <i>Arkansana</i> )	72
Smartweed ( <i>Polygonum Pennsylvanicum</i> )	1,049
Bindweed ( <i>Convolvulus sepium</i> )	23
Spiderwort ( <i>Tradescantia Virginica</i> )	68
Milkweed ( <i>Asclepias tuberosa</i> )	27
Horsetail ( <i>Equisetum robustum</i> )	105
Horseweed ( <i>Erigeron canadensis</i> )	140
Saw-tooth Sunflower ( <i>Helianthus gross-serratus</i> )	99
Western Sunflower ( <i>Helianthus occidentalis</i> )	27
Dandelion ( <i>Taraxacum officinale</i> )	23
Pigweed ( <i>Chenopodium album</i> )	90
Hairy Ground-cherry ( <i>Physalis lanceolata</i> )	9
Indian Hemp ( <i>Apocynum cannabinum</i> )	9
Wild Vetch ( <i>Vicia Americana</i> )	72
Pepper Grass ( <i>Lepidium apetalum</i> )	5

Total Number of Weeds..... 1,836

In a garden in Ames, the ground was in potatoes last year, given ordinary hoeing three times. Black loam, near house.

June 2, 1903.

Name of Weed.	No. per sq. rod.
Smartweed ( <i>Polygonum Pennsylvanicum</i> )	40,324
Hedge Mustard ( <i>Sisymbrium officinale</i> )	3,060
Black Beggar-ticks ( <i>Bidens frondosa</i> )	476
Prickly Lettuce ( <i>Lactuca Scariola</i> )	204
Pigweed ( <i>Chenopodium album</i> )	340
Horseweed ( <i>Erigeron canadensis</i> )	7,412
Dandelion ( <i>Taraxacum officinale</i> )	68
Foxtail ( <i>Setaria</i> )	136,000

In a garden close by, cultivated last season, harrowed well after plowing, cultivated three times. Nothing done after potatoes matured except mowing weeds and digging. Plowed in spring of 1903, harrowed twice. Black loam.

June 2, 1903.

Name of Weed.	No. per sq. rod.
Swartweed ( <i>Polygonum Pennsylvanicum</i> )	1,360
Foxtail ( <i>Setaria</i> )	34,680
Amaranth ( <i>Amarantus alba</i> )	408
Burdock ( <i>Arctium Lappa</i> )	68
Plantain ( <i>Plantago Rugelii</i> )	1,292
Pigweed ( <i>Chenopodium album</i> )	2,244
Hedge Mustard ( <i>Sisymbrium officinale</i> )	1,088
Ragweed ( <i>Ambrosia artemisiaefolia</i> )	68
Purslane ( <i>Portulaca oleracea</i> )	9,384
Horseweed ( <i>Erigeron Canadensis</i> )	204

## THE WEEDS OF THE TWO GARDEN PATCHES COMPARED.

### PATCH I. NOT CULTIVATED IN 1903.

Name of plant.	Number.
<i>Polygonum Pennsylvanicum</i>	40,324



<i>Sisymbrium officinale</i> .....	3,060
<i>Chenopodium album</i> .....	340
<i>Setaria</i> .....	136,000
<i>Erigeron Canadensis</i> .....	7,412
Total all weeds.....	187,884

#### PATCH II. HARROWED TWICE AND PLOWED.

Name of plant.	Number.
<i>Polygonum Pennsylvanicum</i> .....	1,360
<i>Setaria</i> .....	34,680
<i>Chenopodium album</i> .....	2,244
<i>Sisymbrium officinale</i> .....	1,088
<i>Erigeron Canadensis</i> .....	204
Total all weeds.....	50,736

#### THE WEEDS OF THE TWO GARDEN PATCHES COMPARED.

Very many plants are scattered by their underground stems. One of the worst of the European weeds, the water weed, *Anacharis*, is scattered largely by the breaking up of the parts of the plant into numerous small pieces. Common quack grass is largely scattered by means of the rootstocks that creep underneath the ground. The Canada thistle is likewise spread by the underground rootstocks. In fact many of our worst weeds are scattered in this way, stealing a ride perhaps in some packing material around nursery stock, or packing material used around furniture or other commercial articles and in this way are carried far from their home.

The wide distribution of certain plants over the earth's surface can be accounted for only by the means which they have for dissemination. The dandelion (*Taraxacum officinale*) is found over wide areas in the United States and Europe.

The common horse weed (*Erigeron Canadensis*) is found throughout northern United States and even in many portions of Europe where Linnaeus supposed it was carried by the wind. This is, however, extremely doubtful. The bull thistle (*Cnicus lanceolatus*) owes its distribution in northern United States largely to the manner in which the seeds are distributed by the wind. Again the wide distribution in recent years of the Russian thistle (*Salsoli Kali* var. *Tragus*) is another illustration of how weeds become widely scattered because of the adaptations for dissemination. Outside of weeds we might mention cottonwood (*Populus monilifera*) found throughout North America,



its light, airy and fluffy seeds making it an easy matter for them to be carried. Our northern fox grape (*Vitis riparia*) is common everywhere in woods along streams in the United States east of the Rocky Mountains and especially in the Mississippi Valley and the Atlantic states. Through long ages this plant has adapted itself over a wide range of territory, and birds have scattered it far and wide. Our two wild strawberries have a wide

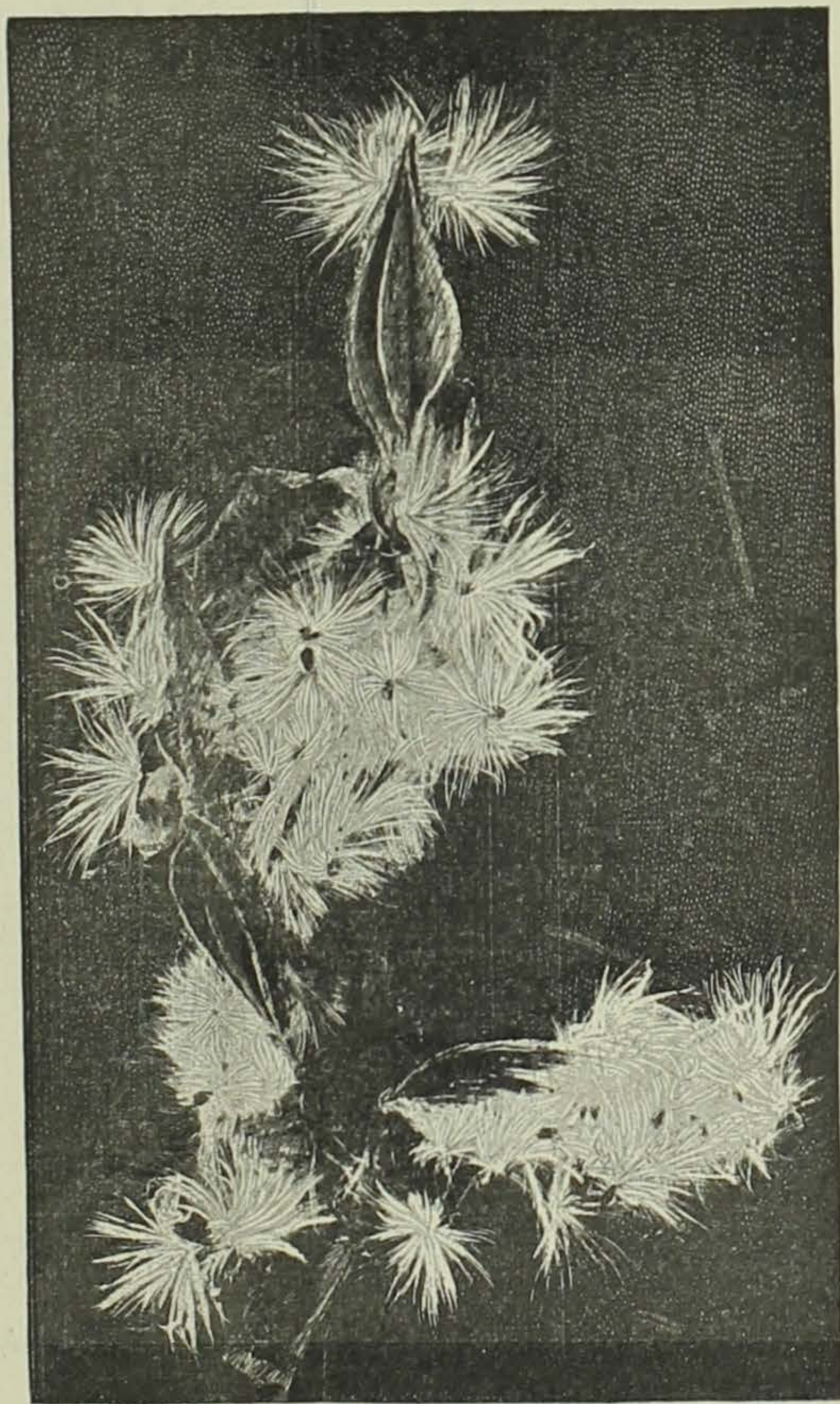


Figure 121. MILKWEED (*Asclepias cornuti*). The light seeds are provided with a tuft of hairs from the end. Thousands of these seeds packed in a pod. (L. H. Bailey).



distribution in eastern north America, and the red raspberry (*Rubus strigosus*) is not only abundant in eastern North America but is a conspicuous plant at higher altitudes in the Rocky Mountains and west to the Pacific coast.



Figure 122. BLUE GRASS (*Poa pratensis*). The light "seeds" with cobwebby hairs cling to the fleece of passing animals. (Scribner Div. of Agriculture U.S. Dept. of Agriculture).

#### CLASSIFICATION OF AGENTS THAT DISSEMINATE PLANTS.

##### I. WIND.

- a. Tumble weeds, Russian thistle.
- b. Winged fruit appendages, Acer.
- c. Winged seed appendages, Asclepias.
- d. Parts of inflorescence with modified expanded bracts, etc.,  
Tilia.



- Disseminated*
- e. Parts of the seed or fruit inflated, *Cardiospermum*.
  - II. WATER.
    - a. Seeds with light inflated pods, *Carex*.
    - b. Enlarged receptacle, *Nelumbium*.
    - c. Mucilaginous seeds, pepper grass.
    - d. Currents of water in a mechanical way, driftwood.
    - e. Plants floating on water by means of air spaces, *Lemna*.
  - III. SNOW AND WIND COMBINED.
    - Many weed seeds.
  - IV. ANIMALS.
    - a. Fleshy edible fruits and seeds, night-shade, cherry.
    - b. Edible seeds that are not fleshy, sunflower, acorn.
    - c. Fruits with hooks or barbs, *Bidens*.
    - d. Seed or fruits with webs, bluegrass.
  - V. EXPLOSIVE PROPERTIES OF FRUITS AND SEEDS.
    - a. Contraction of seed vessel.
    - b. Twisting of pod, vetch.
    - c. Tension in pod, *Impatiens*.
    - d. Shooting of seeds, *Oxalis*.
    - e. Turgidity of fruit, squirting cucumber.
  - VI. CREEPING MECHANISMS AND SEEDS BURYING THEMSELVES.
    - a. Hygroscopic movements, *Stipa*.
    - b. Cleistogamous flowers, violet.
  - VII. MAN AS AN AGENT.
    - a. Impure seeds, clover dodder.
    - b. Common carriers, Russian thistle.
    - c. Nursery stock and flowers, Canada thistle.
    - d. Hay and wool, buffalo bur.
    - e. Plants grown for ornamental purposes, and as food plants, ox-eye daisy, chicory.

Hitchcock and Clothier give a long list of the weeds which are disseminated in Kansas under the following classification:

- I. WIND.
  - 1. Tumble weeds.
  - 2. Tumbling fruit portions.
  - 3. Seeds of fruits with tufts of hairs.
  - 4. Seeds or fruit with wings.
  - 5. Seed coat mucilaginous.
- II. ANIMALS.
  - 1. Fruits of seeds provided with hooks, barbs, or other appendages; with these they become attached to animals.
  - 2. Fruit fleshy; the flesh is eaten by animals, especially birds, but the seeds escape digestion or are discarded.
  - 3. Seed pod upright, on a slender elastic stalk. When animals brush against these, the pod or top of the plant is bent to one side, and when released springs suddenly back, throwing the seeds a short distance. The pod is sometimes provided with projections which aid in catching animals as they pass.
  - 4. Seed small and smooth; persistent on the plant until winter, they are then eaten by birds, especially when there is snow upon the ground. The plants sticking up through the snow are visited by birds who devour the seeds but scatter large quantities upon the surface. These wasted



seeds are blown long distances upon the crust of the snow. This is undoubtedly an important means of scattering such seeds as sunflower, red-root, lamb's quarter and smart-weed.

### III. AUTOMATIC MOVEMENTS.

Seeds scattered by explosion; or some sudden movement in some part of the pod.

### IV. OTHER METHODS.

Water, human agencies.

## WIND AS AN AGENT.

Wind is one of the best means of scattering the seeds of weeds; it carries them faster and farther than any of the other agents. A seed or fruit in order to be scattered by the wind must be light.

*Thistles and fire weeds.*—In our common bull thistle (*Cnicus lanceolatus*) the achene (seed) which is light, bears on its end a large number of long, fine threads (pappus) which are plumose. This pappus belongs to the limb or upper part of the calyx, the outer whorl of the leaves of the flower. The pappus is so arranged in all our species that it forms a neat contrivance for the wind to carry the fruit for a considerable distance from where it was produced.

In the Rocky Mountain country a thistle (*Cnicus Drummondii*) becomes abundant where forest fires have destroyed the timber. In the course of a few years the open woods become

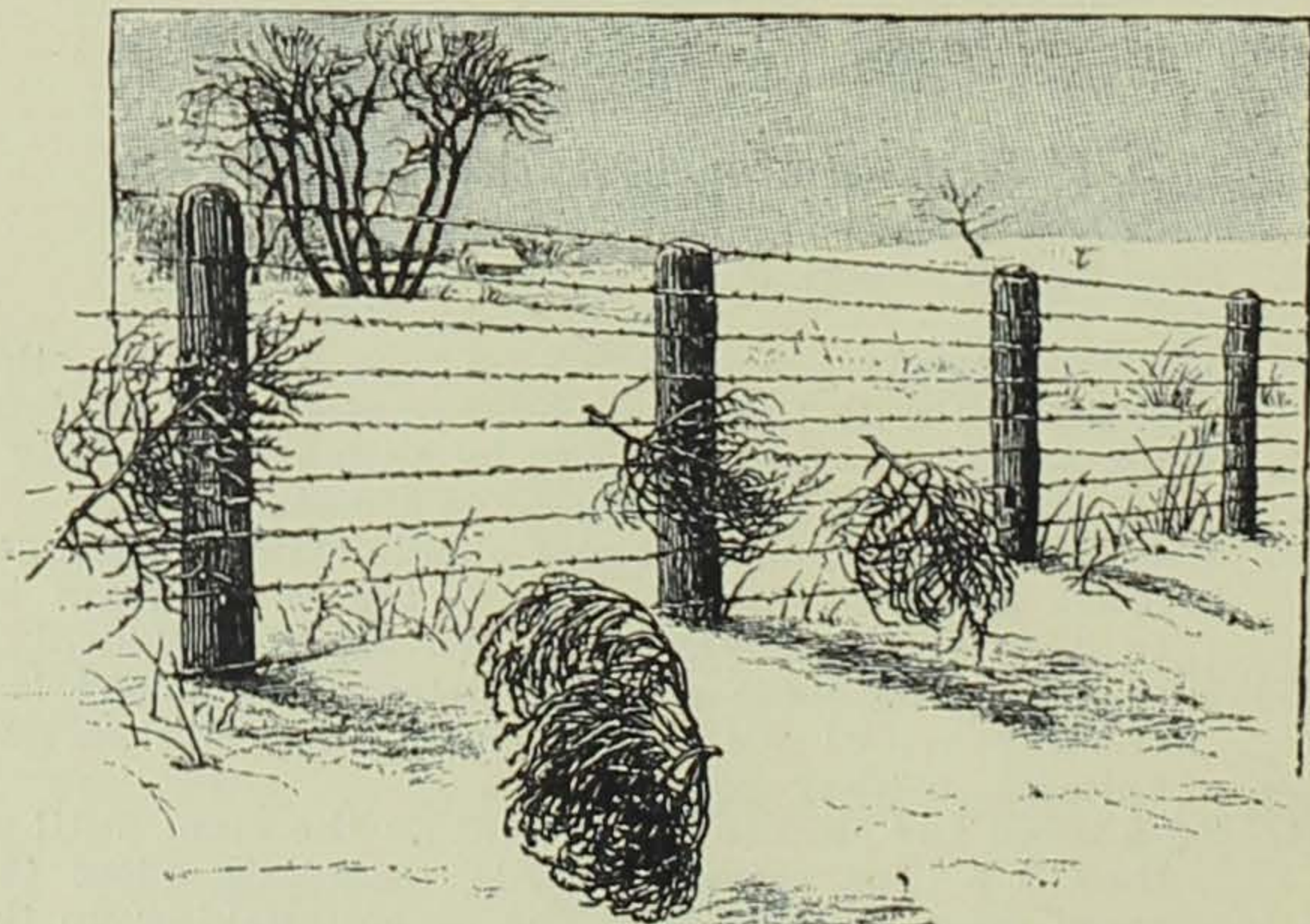


Figure 123. COMMON TUMBLE WEED (*Amarantus retroflexus*). Collecting along a barb wire fence. The seeds are scattered as the plant rolls over the ground. (Bergen).



covered with these plants and not inappropriately these thistles are sometimes called fire weeds. A member of the composite family commonly appearing after woods have been cleared and burned in Iowa is known as fire weed (*Erechtites hieracifolia*). This plant has a downy pappus attached to its seed. Another weed commonly called the fire weed, belongs to an entirely different class, namely the primrose family. The common fire weed of the eastern states and north to the Rocky mountains is the *Epilobium spicatum*. In this case the farmer often wonders where the plants have come from. Because of their abundance he is led to believe in many cases that the seeds were deeply buried



Figure 124. OLD WITCH GRASS (*Panicum capillare*). The light panicle separates from the plant. The wind carries the panicle over the ground scattering the little seed. (Scribner, Div. of Agr. U. S. Dept. of Agriculture).



in the soil, but if he would take the trouble to examine the ripened top of this plant with its numerous seeds he would find that each seed bears a downy tuft of hairs at the end, making it easy for the plant to be carried by the wind. The method of dissemination has been well described by Prof. Beal as follows:

The tips of the hairs stick slightly to the inside of the recurved valves, some hairs to one valve, and often others to the adjacent valve, thus spreading them apart with the seed suspended between. Four rows of the seeds are thus held out at one time. Often not over half, or even a tenth part of the seeds are well developed, yet the silky hairs are present and float away in clusters, thus helping to buoy those that are heavy. This is a capital scheme, for when the pods are dry and unfurled, they silently indicate to the slightest breath of air that they are ready for flight, and it doesn't take much to carry them for a long distance.

*Dandelion and cat-tails.*—The dandelion (*Taraxacum officinale*, Webber), is likewise disseminated by the wind and if anything has a structure better adapted for dissemination than our thistles. Dr. Beal says: "In spring the dandelion is almost everywhere to be found; everyone knows it,—the children to admire, the gardener to despise." The dandelion head rises far above the plant, each head containing a large number of "seeds" (fruits). The seeds are oblong, long-beaked and four or five ribbed, bearing at the end long, soft white capillary threads. The beak is two or three times as long as the remainder of the achene. The whole acting as a parachute, this parachute arrangement enables the slightest wind to carry it away. Little children frequently amuse themselves by blowing the seeds from the receptacle.

Who has not discovered the common cat-tail of our northern ponds and bogs? A single cat-tail contains thousands of "seeds." The small seed is at one end being attached to long slender stalk with fluffy hairs. The seeds are scattered by the wind, but birds aid in breaking up the head.

Dr. Weed says:

You are now in position to appreciate better the meaning of the masses of "cat-tails" to be found by the side of nearly every pond. All through the winter the brown seed-masses project above the ice and snow, where they are visited by many seed-eating birds which peck the heads apart. Thus exposed to the air the tiny parachutes open, forming great fluffy masses that are taken up by the wind and scattered in every direction.

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Seed Dispersal. 41.

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Seed Dispersal. 44.

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Seed Travellers. 12.



## BALLOONING SEED.

*Ballooning Seed.*—Hamilton Gibson says in regard to these ballooning seeds:

Every cobweb will show us a few of them and I have seen a single autumn gossamer that offered an assortment of eight distinct forms, mostly from the great order of composites, the very children of the breeze.

The purple iron-weed of the swamps (*Vernonia*) lets loose a downy fledgling with a row of teeth and a tuft of down for the breeze. The wild lettuce sends out its thousands of flat black tokens, each with a slender bristle tufted at the summit, while a similar plant, the blue lettuce, sees no advantage in this long appendage, but attaches its wings to a tiny disk at the summit of the fruit, a fact which the young botanist appreciates, for this one peculiarity is sufficient to distinguish the plant from its otherwise puzzling neighbor. The aster, cat-tail and golden rod are seen beyond these seeds. And I might follow on in a wide field for investigation among the numberless forms that have sailed out of my picture, but are everywhere to be found in the fields.

Any consideration of winged seed from the young people's standpoint would be incomplete without mention of those glistening, fluffy, fairy globes which deft feminine fingers fashion from the ripening heads of the thistle and bursting milkweeds pods by tying the compact pappus with thread and drying in the sun.

But now in September we may find a plant that furnishes its fairy wares even without the aid of fingers, real brownie dust-brushes by the million, which household fairies find ready for use by the simple addition of a pin for a handle. It is the glistening white puff of the groundsel shrub (*Baccharis*) to be found everywhere along our coast from now until winter.

In our pasque flower or crocus (*Anemone patens* var. *Nuttalliana*) common throughout northern Iowa and the northern states as well as the Rocky mountains, the style is long and slender, covered with long hairs in fruit, giving it the appearance of a feathery tail. Such structures are also found in the Virgin's bower (*Clematis Virginiana*) and in several members of the rose family, like the *Geum triflorum* which produces very long styles developing into a strongly plumose fruit. The beautiful mountain mahoganies (*Cercocarpus ledifolius* and *C. parvifolius*) produces plumose fruits with long tails. In our common milkweed, common everywhere (*Asclepias speciosa* and *A. cornuti*) a tuft of fine hairs comes from the end of the seed. In a member of the mallow family cotton (*Gossypium herbaceum*) the cotton fiber closely invests the seed and is an aid in scattering its seed. So too is the woolly tuft at the base of a cottonwood and willow seed. Female trees of our cottonwood

Sharp Eyes, a rambler's calendar for fifty-two weeks among insects, birds and flowers. 171.



are deemed very objectionable in cities because of the way it scatters its seeds. Any one who will make some careful observations in the autumn or summer will find that the dandelion by its parachute like arrangement, the hairs on the seeds of milk-weeds, or the pappus on thistles are admirable arrangements for the scattering of seeds. The seeds of these plants may be seen sailing through the air.

In many cases there are special contrivances in the way of

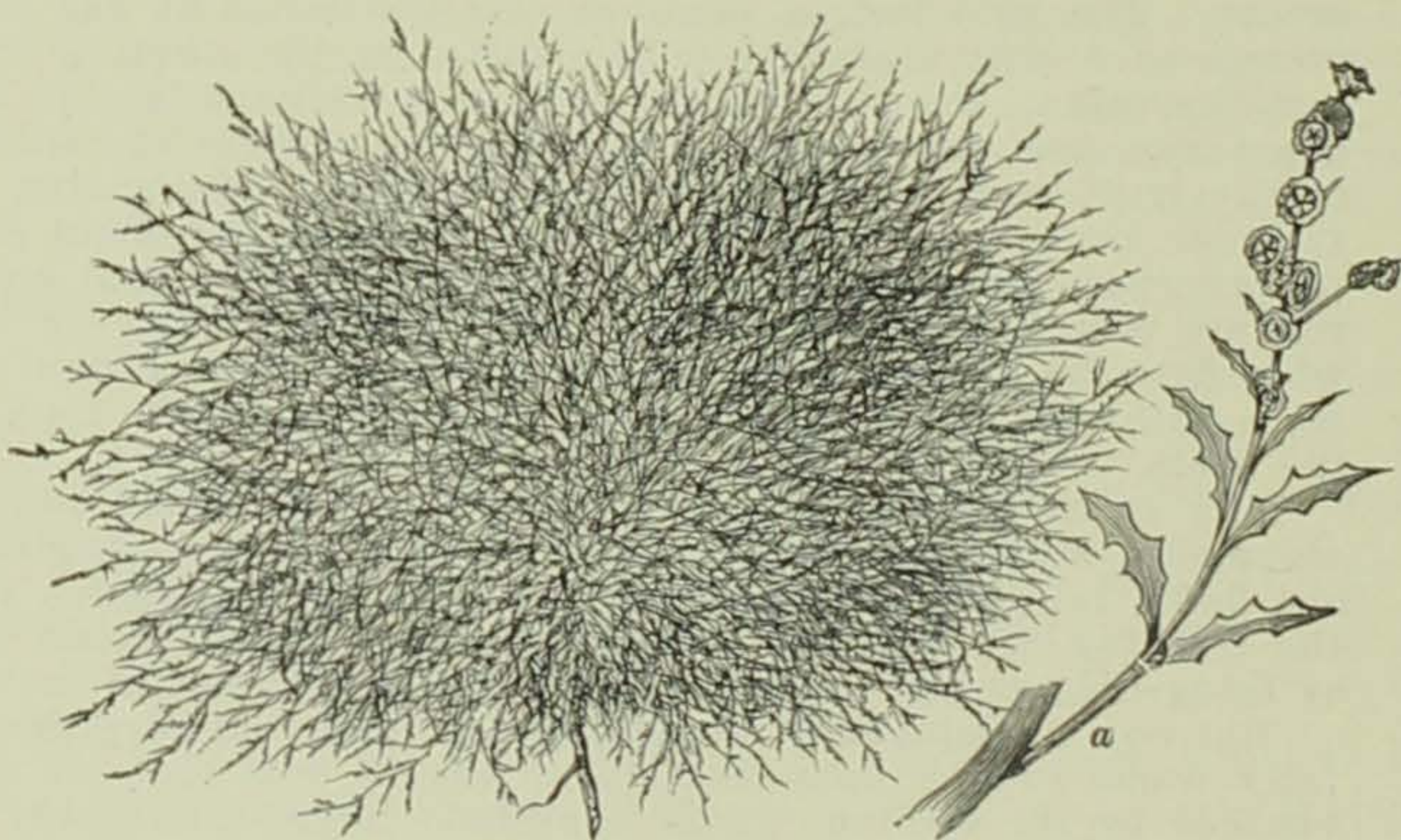


Figure 125. THE WESTERN TUMBLE WEED (*Cycloloma platyphyllum*). Abundant in Kansas, Colorado, Nebraska and coming into Iowa. 1 the circular form of the plant. a. branch enlarged showing the seed. (Dewey Div. of Bot. U. S. Dept. of Agriculture).

winged appendages to the seed or fruit. The thin membrane-aceous wing of a pine seed, of trumpet creeper (*Tecoma radicans*), of catalpa (*Catalpa speciosa*), or the winged fruits of elm (*Ulmus*), of malpes (*Acer*), of ashes (*Fraxinus*), of birches (*Betula*), all give these plants means of dispersal. Who has not seen the seeds and fruits of those plants scattered for some distance from the parent plants? Who has not seen the soft maple fruits spinning through the air and dropping it in the soft earth or in the lawn with the seed end down so that it may strike the moist earth where it will find a favorable opportunity for germination at the earliest possible moment, for these seeds do not retain their vitality for a great length of time.

*Inflated pods.*—In another division of the wind disseminated plants they are rendered buoyant by means of the inflation of the ovary or pod. This is true to some extent in the bladder nut (*Staphylea trifolia*) common everywhere in low grounds in the Atlantic region and the Mississippi valley. The tough in-



flated papery pods contain a few small bony seeds. As this plant is also disseminated by the water and snow we shall speak of it in another connection. Another plant belonging to the same family is the balloon vine or heart seed (*Cardiospermum Halicacabum*) producing a loose and inflated seed pod consisting of three cells, each bearing a small hard seed furnished with a small aril. These pods are easily carried by the wind. The plant is probably native from southern Florida to Texas and has become established in parts of Illinois, through Texas and Arkansas. The balloon vine is becoming a weed in fields in Illinois. In some species of corn salad (*Valerianella*) the ovary, although it has three cells, only one contains a seed, the others are much larger and become inflated.

Sir John Lubbock says:

Thus, in *Valerianella auricula*, the fruit contains three cells, each of which would naturally be expected to contain a seed. One seed only, however, is developed, but as may be seen from the figure given in Mr. Bentham's excellent Handbook of the British Flora, the two cells which contain no seed actually become larger than the one which alone might, at the first sight, seem to be normally developed. We may be sure from this point that they must be of some use, and, from their lightness, they probably enable the wind to carry the seed to a greater distance than would otherwise be the case.

*Tumble weeds.*—People who have lived in a prairie country are very familiar with the habit that some plants have of growing in a rounded and bushy form, and in the autumn the whole plant breaks away close to the surface of the ground. They are then carried by the wind for great distances. One species of Amaranth (*Amarantus albus*, L.), is a common tumble weed in Iowa. Great numbers are found every fall and winter in corners of fences or they pile up in ditches or other places where they find lodgment. The accompanying illustration taken from Bergen shows pretty well how these plants collect along the fences. I have occasionally seen them so abundant that they obstructed the view of the wire fences.

The mother plant now dead, toiled busily during the heat of summer and produced thousands of little seeds. The best portion of her substance went to produce these seeds, giving each a portion of rich food for a start in life and wrapping each in a glossy black coat. Now she is ready to sacrifice the rest of her body to be tumbled about, broken in pieces, and scattered in every direction for the good of her precious progeny, most of whom will find new places where they will stand a chance the next summer to grow into plants. Sometimes the winds are not

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Flowers, Fruits and Leaves. 67.

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Bergen. Foundations of Botany. 380.



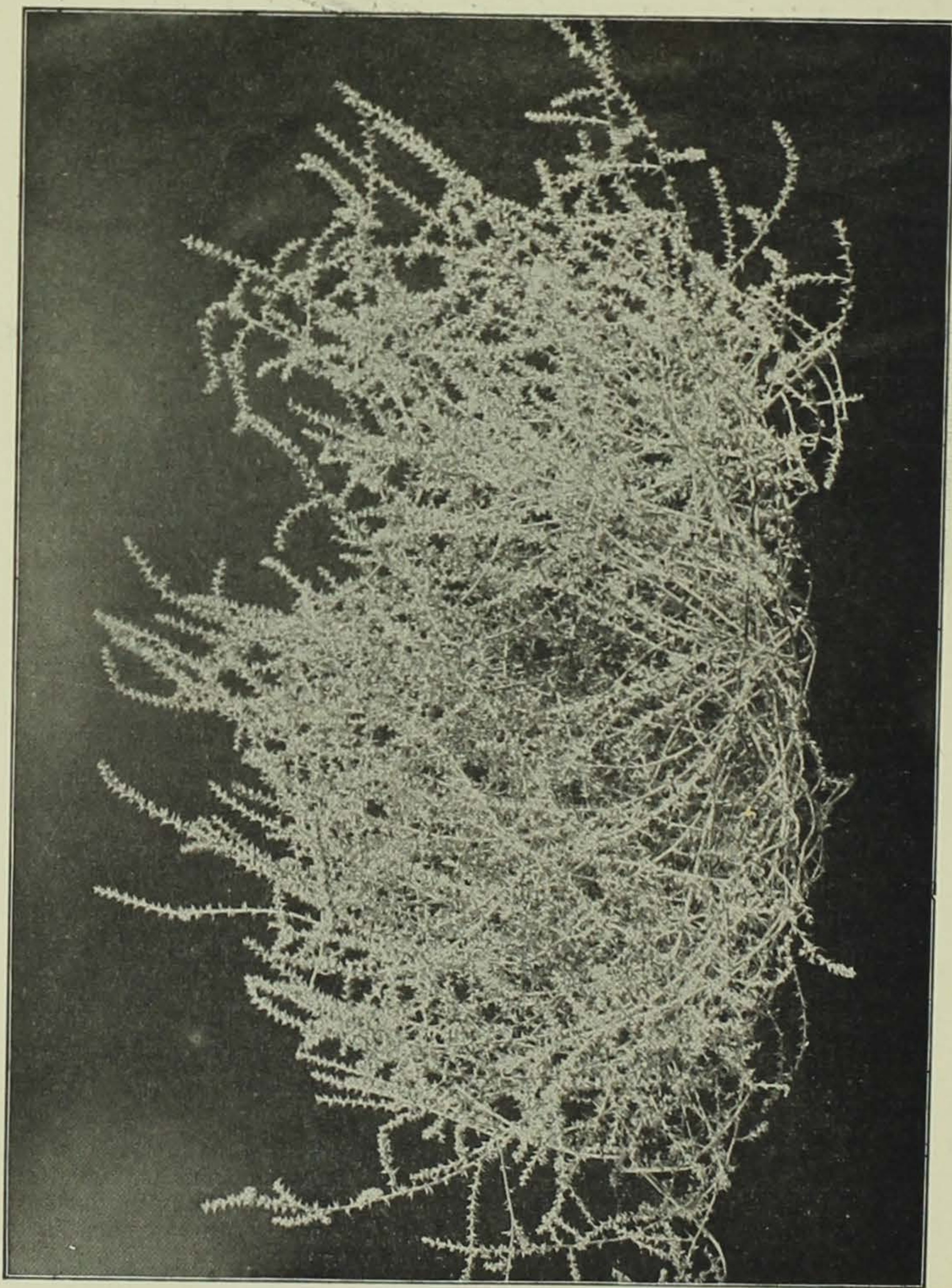


Figure 126. THE SPHERICAL FORM OF THE RUSSIAN THISTLE (*Salsola Kali* var *Tragus*). Widely scattered by the wind. (Dewey Div. of Bot. U. S. Dept. of Agriculture.)



severe enough or long enough continued, and these old skeletons are rolled into ditches, piled so high in great rows or masses against fences that some are rolled over the rest and pass on beyond. Occasionally some lodge in the tops of low trees, and many are entangled by straggling bushes. In a day or two, or in a week, or a month, the shifting wind may once more start these wrecks in other directions, to be broken up and scatter seeds along their pathway.

Our spiny nightshade or buffalo bur (*Solanum rostratum*) has this tumbling habit. This plant grows in immense quantities in Texas, Indian Territory, Kansas, the plains east of the Rocky mountains, abundant in some places in Nebraska, and spreading



Figure 128. Canada Thistle "seed" with appendages. Fruit and papery calyx with attached "seed" of Russian Thistle. Russian Thistle seed.

rapidly in this state. The plant grows in the usual spherical form, and produces spiny stems and leaves. The yellow flowers are like the potato blossoms, but it forms a bur-like fruit enclosing the real berry. Animals generally leave the plant alone except the potato beetle which is said originally to have fed on this plant and then took to the potato. In the fall when the plant is dead and dry it breaks off close to the ground and is carried like our common tumble weed, its seeds falling out here and there along the way.

One of the most common and largest of the tumble weeds of Kansas, and Nebraska, and occasionally found in Iowa is *Corispermum hyssopifolium*. A friend who once traveled in western Kansas saw some gigantic objects in the distance, remarked to a person standing by him about the abundance of deer. His deer were immense tumble weeds of this species. The "Rose of Jericho" (*Anastatica Hierochuntica*) a small annual cruciferous plant growing in the sandy places of Egypt, Syria and Arabia curls up when dry into a round ball. It is then driven by the wind until it finds a damp place, where



it uncurls, the pods open and the seeds are sown. The tumbling habit of this plant seems to have been well known to the ancients. The appearance of this plant was a great wonder to the ancients.

Russian thistle (*Salsola Kali* var. *Tragus*).—This plant has long been known to the people of Russia as a tumble weed, being native to southeastern Europe and western Asia, especially in Siberia where for ages it has been a troublesome pest of grain and flax fields. And long ago it received the common appellation of "leap the field." Well described by Henfrey.

Prof. Budd says:

That in eastern Samara, Saratov, the "leap the field" is found mingled with tulips, lucerne, feather grass, and other grasses, mulleins, asparagus and sage.

The Russian thistle grows in a circular and bushy form. The mature plant is quite tough, and would remain in situ but for the action of the wind which causes the plant to move now in one direction, and then in another, assisted also, frequently, by the slightly frozen ground. Once separated from the root the winds of autumn and winter compel it to roll over and over till it comes against some temporary object, here it remains till shifting winds cause it to roll against some other temporary object. The shifting winds may again cause it to reverse its course or move in another direction. Its power to compete with other plants is wonderful, since a single plant, two or three feet in diameter, is estimated to bear from 20,000 to 30,000 seeds. Professor Fletcher estimated that a plant six feet in diameter, bore 200,000 seeds. Nor are all the seeds dropped at once. Mr. Dewey made the interesting observation that the mature flower with its seeds is held in the axils of the bracts by two minute tufts of coiled hairs, which prevents the seed from falling out at once when the weed begins to roll. There are also other means of scattering. The fruit, with its papery calyx, when removed from the plant, is sometimes carried for short distances by high winds. The seeds are also carried along the snow for a considerable distance, the papery calyx well serving the purpose of allowing the wind to carry it along as a sailboat is moved forward on the water.

Some of our grasses are rolled by the wind. Old witch grass (*Panicum capillare*) may frequently be seen rolling over the fields in autumn. The wind may also carry the inflorescence

—Henfrey. Vegetation of Europe, its conditions and causes, London, 206. 1852.

—Bull. Ia. Agrl. Exp. Sta. 26: 31.



containing the seed. The grass (*Spinifex squarrosus*) of Australia forms a large round head which is driven before the wind. The constant jarring of these plants as they are carried over field and prairies causes the seed to be threshed out, and sowing them broadcast; the farmer wonders where his seeds come from.

The common hair grass (*Agrostis scabra*) likewise is disseminated by the wind, becoming a tumble weed. The inflorescence is light and airy and easily separates from the plant, scattering the fruit far and wide. A species of *Eragrostis* (*Eragrostis major*) or stink grass is likewise scattered in this way. Our



Figure 130. THE DANDELION. (*Taraxacum officinale*). The beaked "seed" with pappus attached which enables the seed to be scattered by the wind.

pepper grasses (*Lepidium apetalum* and *L. Virginicum*) growing in a spherical form, are especially common in the fall although making their appearance early in the season continue to flower and produce seed until frost. The plant breaks away from the root and thus becomes a tumble weed. Other plants like spurge, (*Euphorbia Preslii*), Chenopodium, and several species of Baptisia, like *B. leucantha* and others are tumble weeds. Many



other might be added. South America, Africa, Australia each have their own type of tumble weeds. This illustrates again how structures in diverse orders of plants are brought about to meet certain requirements.

*Poppy*.—In the poppy where we have a large number of seeds produced the wind assists in dissemination. In the poppy pod the upper part of the capsule has a large number of little openings. A little shaking by the wind will cause the seeds to come out one by one.

These are well described by Miss Morley:

The poppy pod is like a cup with a cover on, but around the edge, just below the cover, is a row of small holes, each covered by a lid. These lids do not open until the poppy seeds are ripe; then they do, and the fine seeds can get out of the holes. But *how* do they get out? They cannot move of themselves, but the wind sways the poppy pod this way and that on its long stalk, and the little seeds are shaken out only to be caught by the wind and blown away.

In some species of the bell flower (*Campanula*) the capsules are either pendant or upright. In the upright species they open at the top and in the pendant at the base.

*Elaters*.—The elaters of some of the liverworts like the *Marchantia* are peculiar hygroscopic cells with spiral bands due to the thickening of the cell wall. It was thought at one time that these had something to do with the dispersal of the spores but it is thought rather that they serve for the purpose of holding the spores together after the opening of the receptacle and thus expose them by degrees to the wind.

In the horsetails like *Equisetum* the spores are surrounded by bands that come from the outer wall of the spores. In the mature specimen before they are liberated they are spirally coiled but in dry weather the spiral bands unroll or straighten out and form appendages enabling the wind to carry the spores away.

## WATER AS AN AGENT.

Water is an efficient means of scattering the seeds and fruits of many of our plants. One need only visit the banks of our

M. W. Morley. *Little Wanderers*. 59.

Arthur, Barnes, and Coulter. *Plant Dissection*.

Kerner. *National History of Plants*. 2: 813.

Tilden. *Bull. Minn. Bot. Studies*. 9: 43.

Underwood. *Hepaticae of North America*. *Bull. Ill. State. Lab. Nat. Hist.*



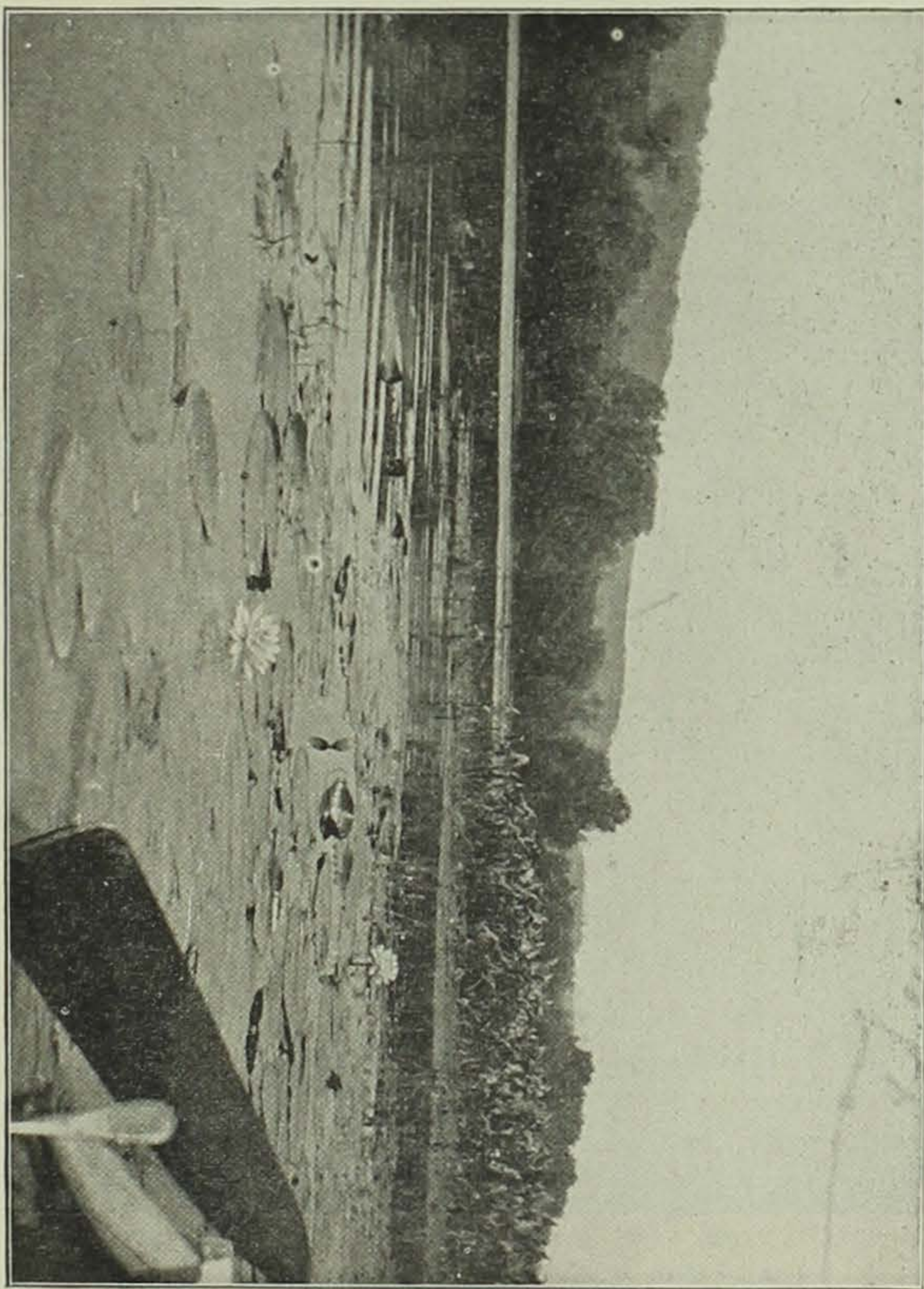


Figure 131. Water lily "seed" scattered by the water. (Photo Charlotte M. King. Courtesy, Iowa State Hort. Society).



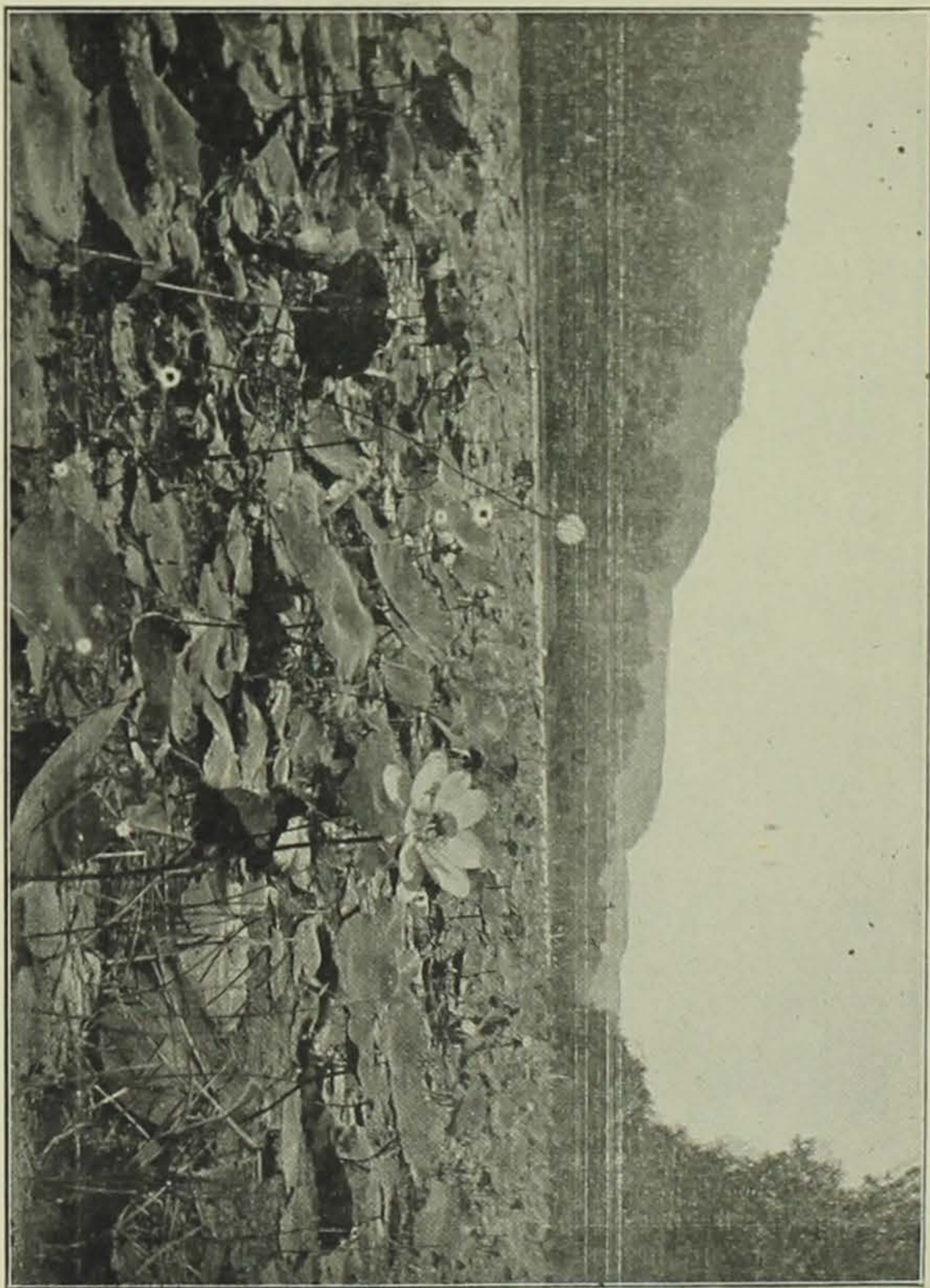


Figure 132. NELUMBO OR CHINQUEPIN (*Nelumbo lutea*). The long stalk and receptacle standing out of the water. The receptacle contains the seeds. The former with its load of "seeds" is carried by the water. (Photo Charlotte M. King. Courtesy Iowa State Hort. Society).



streams or the flats of lakes and rivers in the autumn and spring after the water has receded from the land and observe the enormous numbers of plants that have found lodgment everywhere in such places. Or if one were to examine the drift wood floating down our streams for many miles one can observe the efficiency of this mode of travel.

Prof. Prentiss says:

As one travels for hundreds of miles along a river, continually encountering the same species, it would be impossible not to believe that the river itself had much to do with planting the vegetation which clothes its shores. A seed to be carried great distances must have (1) something to protect the embryo so that germination or decay will not take place before it reaches its destiny. (2) They must be lighter than water, otherwise they cannot be carried a great distance. Of course freshets often carry seeds that are heavier than water, just as woods of various kinds, stone and dirt are moved, but in running streams lightness and a protective covering are essential. A study of the vegetation along our streams, like the Mississippi will disclose many species common from St. Paul to St. Louis, of plants too in which the "seeds" are carried by the wind usually, as the soft or silver maple, river birch, green ash, some sedges and grasses.

Still waters and stagnant lakes are of less importance than running streams and oceanic currents yet the short waves which appear on such bodies of water certainly transport many of the lower forms of plant life, as well as plants like duckweed (*Lemna*), bladder worts (*Utricularia*), etc.

The leaf and thread-like branches of the *Utricularia* float on the water and though the plant produces seeds that come from the yellow flowers that rise above the water, the plant in addition to its seed production has another means of scattering to which Dr. Beal calls attention. The compact tips of the plant are severed from the barren plant and float upon the water.

Late in autumn or early winter, when cold threatens, the tender bud contracts a little, and, having thus become heavier than water, slowly go to the bottom to spend the winter safely protected in the soft mud. All the plant perishes except these buds. With the lengthening days of spring the melting ice disappears, and genial sunshine gives notice to the dormant buds that it is safe to come out again. The buds begin to expand, become lighter than water, and are soon seen spreading out at the surface and produce branches and leaves. Ducks and other water fowl not infrequently carry some of these wet buds sticking to their feathers or legs."

*Duckweeds and the like.*—Water is a most important agent in the dissemination of plants like the duck weed (*Lemna*) which forms an unsightly mass on the surface of the water and pools, because its loose cellular tissue and air spaces admirably adapts it to float on the water.

This plant often travels for considerable distances. A friend



of mine once traced a leak in a water main by means of one of these duck weeds.

In *Sagittaria*, which occurs on the margins of shallow ponds, the so-called seed is a fruit which is surrounded by a corky wing which renders it buoyant and thus enables the seed or fruit to be carried by the water. In addition to this the fruit has a smooth oily rind. Many other water plants like the *Alisma*, cat-tail and our wild rice (*Zizania aquatica*) with its long narrow fruit is enabled to float on the water. In some experiments made by the writer it remained on the water for more than half an hour.

*Dock*.—The common dock is largely disseminated by the water.

Dr. Beal speaks of it thus:

Narrow-leaved dock is a prominent weed, and is especially at home on river bottoms and on low land that is flooded once in a while.

Did you ever wonder what could be the object of a round, spongy tubercle on the outside of each of these sepals which hold the ripened seed closely? I did not know their use for a long time, but now think I have discovered their meaning. They are not exactly life preservers, but the next thing to it. The naked, seed-like fruit, the shape of the fruit of buckwheat, sinks at once when free from everything else, but with the dry calyx attached, it floats with the stream.

*Sedges and water lilies*.—Our sedges, common inhabitants of low swampy places, and borders of streams are likewise disseminated by the water. The seed-like fruit is surrounded by a loose covering which allows it to be carried.

The seeds in some of the water lilies (*Nymphaea tuberosa* and *N. alba*) are enveloped by a sac-like mucilaginous fluffy arillus. This buoyant body has considerable air and thus the fruit is enabled to float away. The mucilaginous material of the arillus scatters the seed some distance from where it was produced.

The wild lotus (*Nelumbium luteum*) keeps on the surface of the water by means of a large pod shaped receptacle which is conical something like a top. It is light, because of the numerous air spaces.

*Land detachments*.—It is of frequent occurrence to see large detachments of land removed from the shores of lakes; in this case of course all the plants will be carried with it. I have seen cases of this kind on Lake Mendota, Wisconsin. Prof. Prentiss says: "Grassy islands break away from marshy places and float



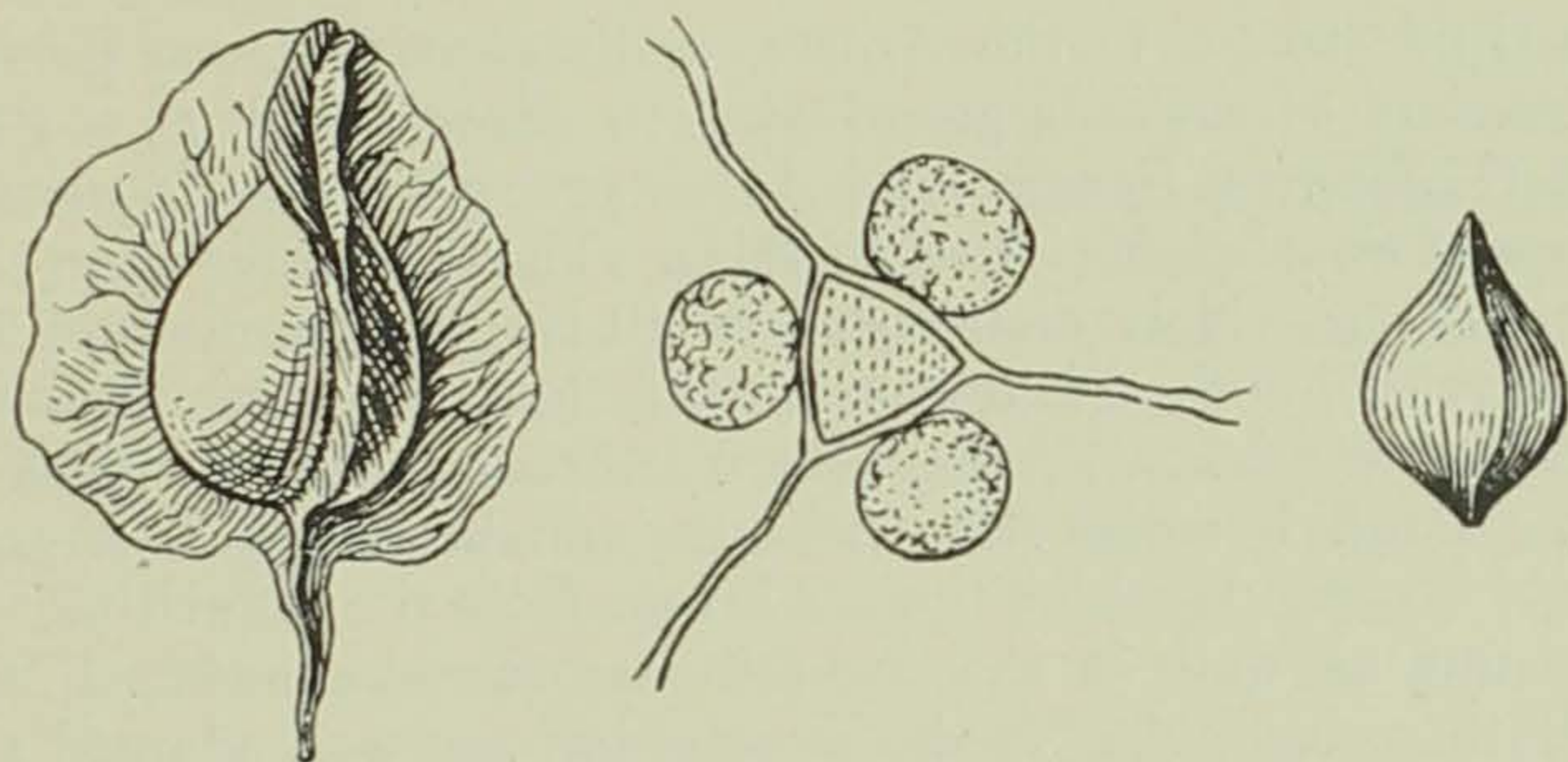


Figure 133. NARROW LEAVED DOCK (*Rumex*). With corky wings making an excellent float. 1. Fruit and adherent calyx. 2. Cross section of the same. 3. "Seed" (*Achenium*). (W. J. Beal).

with the current; the writer has seen them of large size well stocked with seeds and living plants, floating with the currents of the Amazon." Drift timber as Darwin notes may be an agent in carrying seeds, not only in fresh water but ocean currents.

A seed to be carried by oceanic currents must be more protected than those carried by land currents, as many seeds soon lose their vitality when immersed in salt water, though Martens found that one in fourteen species germinated after floating on sea water for three months. On the authority of Dr. Hooker the seeds of *Entada scandens* of the West Indies were carried by

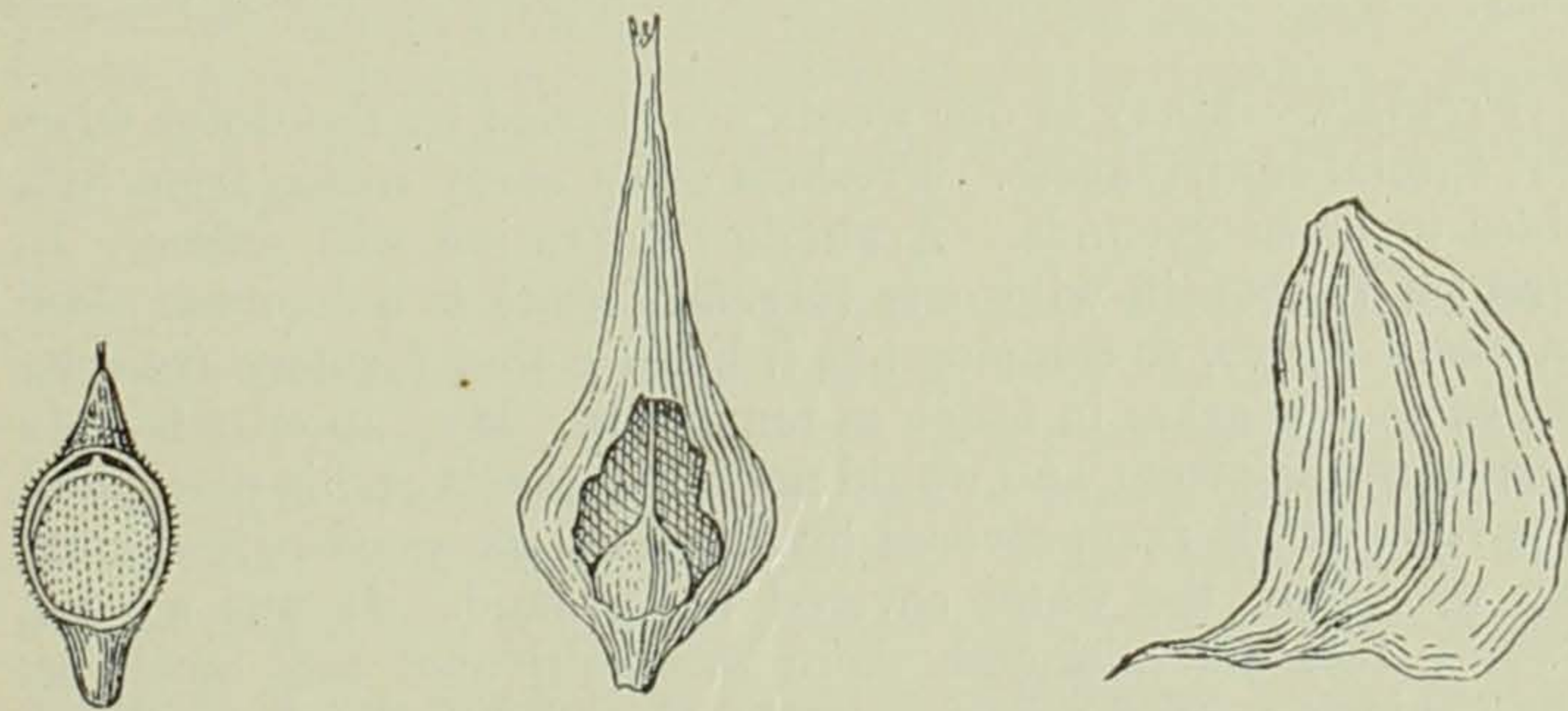


Figure 134. One of the Sedges (*Carex communis*) disseminated by the water. The sedge "seed" without the covering sinks readily but when provided with this loose covering shown in figure to the right. Fruit of arrow head (*Sagittaria*) with corky margins floats readily on the water.

— Origin of Species. 326.

— Darwin, Origin of Species. 325.



the Gulf stream to the Azores, a distance of three thousand miles, and afterwards germinated in Kew Gardens. Plants like *Guilandina Bonduc* and *Abrus precatorius* are common to shores of South America and Africa. The cocoanut palm (*Cocos nucifera*) is widely distributed in all tropical countries. They are carried hundred and even several thousand miles by oceanic currents, and when washed ashore are still capable of germinating. Prof. Prentiss states that the inhabitants gather quantities of cocoanuts which the sea brings from the Mauritius. The cocoanut as well as the leguminous plants mentioned above and others belonging to the same order, are well adapted to be carried by the sea. This accounts for the wide distribution of many Leguminosae in tropical countries.

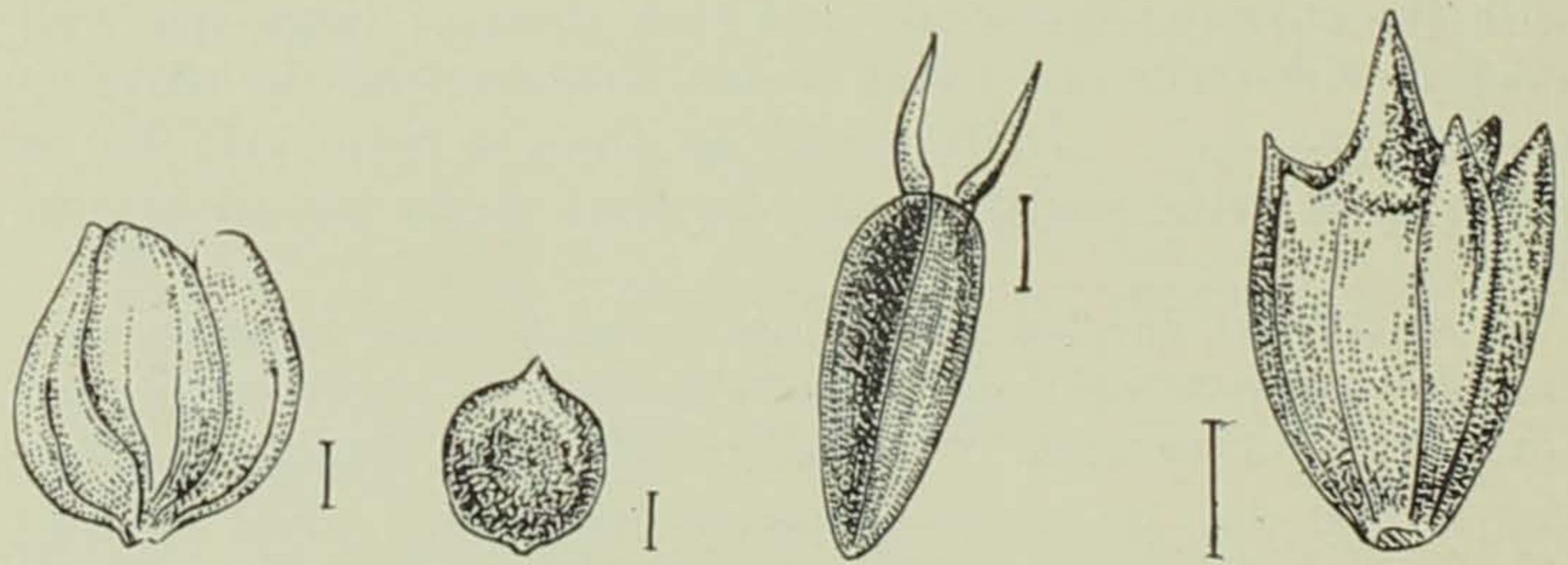


Figure 135. SEEDS AND FRUITS SCATTERED BY FRESHETS. 1, Smartweed (*Polygonum*); 2, Sunflower (*Helianthus*); 3, Ragweed (*Ambrosia*). (Charlotte M. King).

*Freshets.*—Many of our weeds are carried by the water without special contrivances. Freshets often carry weeds from hill-sides to lower grounds. A single illustration will suffice. In western Wisconsin wild oats (*Avena fatua*) is a common weed in many places, so common has it become that farmers are compelled to sow grass in order to remove it. My father, who is a most careful farmer and would not allow weeds on his place, had a portion of his farm covered by this pest, the weed only springing up where the water covered the ground. It was a noteworthy fact that although there was cultivated oats much beyond this part of the field none of the wild oats appeared, excepting the water covered portion as stated above.

The writer has called attention to the importance of irrigation water in distributing plants in the west. Throughout the west, along irrigation ditches such plants as the oyster plant (*Tragopogon porrifolius*), *Lactuca Scariola*, the two sweet clovers, *Me-*



*lilotus alba* and *M. officinalis* are abundant everywhere in irrigated fields in Colorado. These ditches are also lined with such plants as *Iva xanthiifolia*, *Helianthus annuus* and *H. petiolaris*, *Hordeum jubatum*, *Agropyron tenerum*, *Ranunculus multifidus*, var. *terrestris*, and species of *Sagittaria*. They soon become lined also with species of willow like *Salix interior* and *S. amygdaloides*. In Utah very much the same thing occurs. Growing spontaneously as the result of water dispersal, we find such plants in the Salt Lake Basin, as *Salix interior* and *Salix lasian-dra*, *Poa Wolfii*, *Helianthus petiolaris*, *Urtica holosericea*. Close to the foot-hills one finds such plants as *Epipactis gigantea*. Along the irrigation ditches in the Uintah Mountains one finds far from their source the following: *Aconitum Columbianum*, *Geranium Fremontii*, *Thalictrum Fendleri*, *Gayophytum ramosissimum*, grasses like *Calamagrostis Canadensis*, *Poa pratensis*, *Bromus Porterianum*. At least on the dry plains before irrigation such plants as the sage brush *Artemisia tridentata*, *Orthocarpus Tolmei*, *Ericoma cuspidata*, *Stipa comata*, with a host of vernal blooming plants consisting of Anemone, butter cups, etc., are more or less widely scattered. After the water is turned in a great change takes place, *Castilleia*, *Cnicus Drummondii*, *Linum perenne*, *Geranium Fremontii*, *Allium brevistylum*, and many others make their appearance.

*Snow.*—We come now to consider the scattering of weeds by the snow. Certain weeds, like rag weed (*Ambrosia*) and sun flower may be seen gliding over the snow in winter. The smooth frozen snow enables a very slight wind to carry it along. Snow thawing in the winter or spring causes seeds to be carried along with the water.

On the matter of seeds sliding on the snow, Prof. Bolley determined by actual experiment as follows: On January 31, 1895, when there was a light fall of snow upon a smooth frozen sheet of snow with wind blowing at the rate of twenty miles an hour, a peck of seed was thrown on the snow. Thirty rods distant was a small trench four rods long to catch the drifting snow. After the lapse of ten minutes he found the following seeds in the trench:

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Trans. Acad. St. Louis. 7: LXVI.

Bull. N. D. Agrl. Exp. Sta. 17: 102.



Kind of Seed.	No. of Seed.	Kind of Seed.	No. of Seed.
Millet	Numerous	Buckwheat	43
Wheat	191	Ragweed	91
Flax	53		

He concluded that very many of our weed seed could be carried in this way.

Dr. Weed says:

You may often observe a similar process of seed distribution on ponds in winter. On the side of the pond away from the direction of the prevailing wind there will be found windrows of seeds of sedges and other plants that have been blown upon the ice across the pond.

### ANIMALS AS AGENTS.

Without animals many seeds and fruits would not be disseminated. There are two types of seeds and fruits scattered by animals. In the first type the fruits are conspicuously colored, a part is fleshy and edible, the embryo is protected by a hard covering as in plum, grape, etc. In the second type fruits are adhesive by producing outgrowths or bristles and prickles.

*Birds.*—Birds are most important agents in the dissemination of seeds. Of these the crow is one of the most important birds in the scattering of seeds. Messrs. Barrows and Schwarz state: "Almost every crow stomach taken in winter contained remains of grass or weed seeds. The quantity, however, was usually so small as to be entirely insignificant. It is only natural that a bird which gets almost all its food from the ground should pick up a few small seeds every day. In some cases considerable numbers of seeds were found in the stomach, but in no case were they of great importance. The presence of seeds of various knotweeds (*Polygonum*) has been noticed already; next in abundance should be mentioned the bitter weed or ragweed (*Ambrosia artemisiaefolia*). The seeds of several other kinds of ragweeds also occur, notably the giant ragweed (*A. tridentata*). In addition to these a few stomachs contain seeds of amaranth (*Amaranthus*), clover (*Trifolium*), mallow (*Malva*), foxtail grass (*Setaria*), and other grasses. Amaranth seeds are so universal and abundantly distributed in waste places that the few consumed by crows can not have any effect in lessening the abundance of the weeds. The same probably is true of ragweed (*Ambrosia*), knotweed (*Polygonum*), and dock (*Rumex*). An examination of the castings of crow at the roosts showed that a considerable

C. M. Weed. Seed-Travelers. 25.

Barrows & Schwartz, Bull. U. S. Dept. Agrl., Div. Ornithology and Mammalogy, 6:80-81.



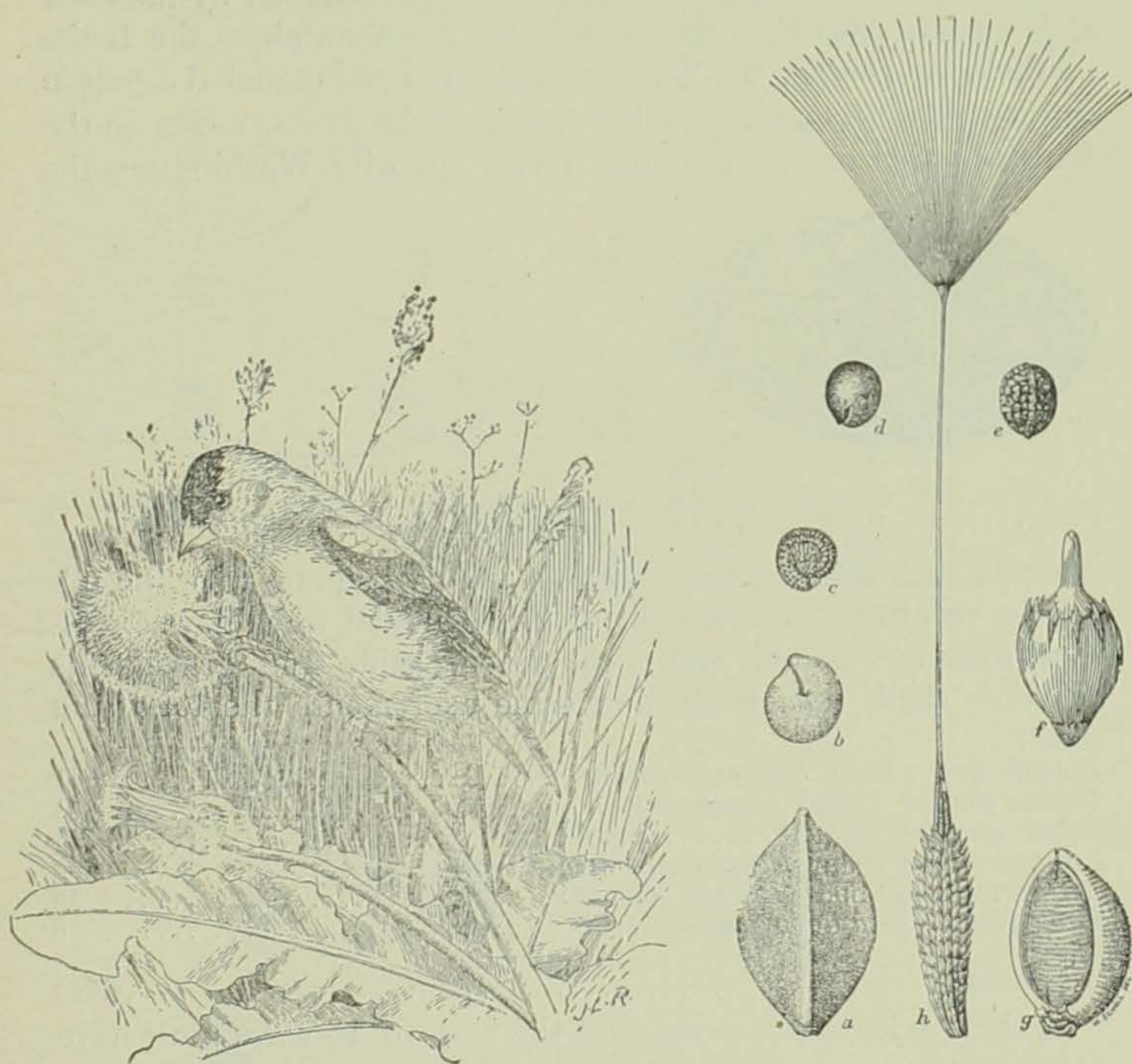


Figure 136. GOLD FINCH EATING THE FRUIT OF THE DANDELION (*Taraxacum officinalis*) and thus assisting in its scattering and the destruction of weed seeds.

Figure 137. WEED SEEDS COMMONLY EATEN BY BIRDS. *a*. Bindweed (*Polygonum convolvulus*). *b*. Lamb's quarters (*Chenopodium album*). *c*. Purslane (*Portulacca oleracea*). *d*. Amaranth (*Amarantus retroflexus*). *e*. Spotted Spurge (*Euphorbia*). *f*. Ragweed. *g*. Pigeon Grass. *h*. Dandelion. (Judd U. S. Dept. of Agriculture.)

number of seeds of the giant ragweed appeared to be indigestible and had been ejected with the other indigestible matter of which the castings are composed. It is possible that such seeds may not have lost their germinating power, but even in that case the number thus distributed would be small and the effect of no great importance. The average of grass and weed seeds for the year was less than half of one per cent.

Fragments of seeds and a few seeds impossible to identify occurred in perhaps a dozen stomachs, but the total amount was only about one-fourth of one per cent of the food for the year."



In addition to these plants that are disseminated by the crow it is certain also that they scatter in great numbers the fruits of the wild cherry, the dog wood, the red cedar and the poison sumac. Mr. Barrows says that in one of the winter roosts on the Virginia side of the Potomac river, opposite Washington, the



Figure 138. Crowcasting containing the weed seeds of various weeds, Sumach, Poison Ivy, etc. (Barrows U. S. Dept. of Agriculture).

material was selected from an area two feet square with the following results: "The weight of this material when dry was almost exactly 1 pound, and it contained (aside from gravel, bits of bone, shell, corn hulls, and some excrement) the following seed:

Poison Ivy ( <i>Rhus Toxicodendron</i> ) .....	1,041
Poison sumac ( <i>Rhus venenata</i> ) .....	341
Other sumacs ( <i>Rhus</i> ) .....	3,271
Juniper or red cedar ( <i>Juniperus Virginiana</i> ) .....	95
Flowering dogwood ( <i>Cornus florida</i> ) .....	10
Sour gum ( <i>Nyssa aquatica</i> ) .....	6
Total .....	4,764

A little calculation shows that the roost of 15 acres must have contained upward of 778,000,000 seeds, or more than enough to plant 1,150 acres as thickly as wheat is sown."

It may be of further interest to state that these ingested seeds are hastened in germination. "Of one hundred seeds of *Rhus venenata* from the roost, moistened and kept warm, ten sprouted within forty-eight hours, and twenty more within the next five days. One hundred and fifty seeds of the same kind and from the same source were planted in a flower pot in the greenhouse and at the end of fourteen days one hundred and thirty of them were vigorous seedlings from one to two inches high, and several more were breaking the ground. Similar results were obtained with seeds of *Rhus Toxicodendron* from the roost, while seeds taken from the vine had not sprouted at the end of fourteen days. Thus it becomes certain that these seeds are improved

1. c. 23.

Rept. U. S. Dept. Agri. 1888. 509.



rather than impaired by their passage through the digestive organs of the crow, and this bird therefore is doing incalculable harm by sowing broadcast the seeds of a poisonous vine and a more poisonous shrub, both of which unfortunately are too abundant already."

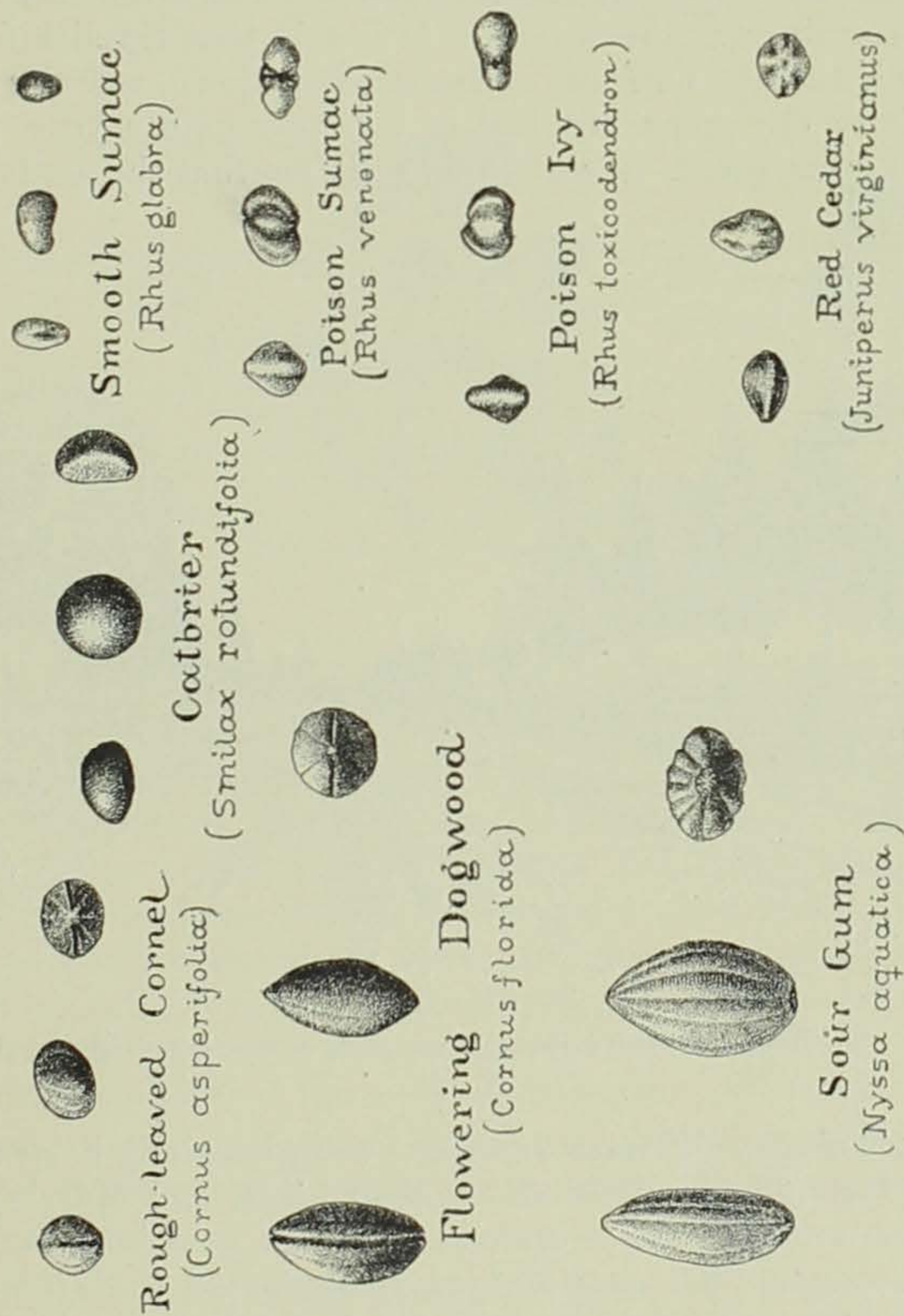


Figure 138 1/2. SEEDS FOUND IN CASTINGS OF CROW. (Barrows, U. S. Dept. of Agriculture).

Birds are important in scattering our bright colored fruits. Every one knows how difficult it is to keep birds from cherry trees, both wild and cultivated, the bright red colors are very attractive and being edible, are devoured by birds. But the bird often carries off the whole cherry to eat the flesh on a neighboring



or distant tree, dropping the seed and the fruit. It is true although they do not swallow so many cherries occasionally one is swallowed. The bird flies away, the seed is dropped in the excreta, which passes through the digestive organs uninjured. There is no question that in some cases at least germination is hastened by passing through the animal. It is said that English farmers feed their turkeys with the common white thorn, sow the "seed" taken from the excrement and in this way gain a year in the growth of the plant. Prof. Budd tells me that the seeds of the

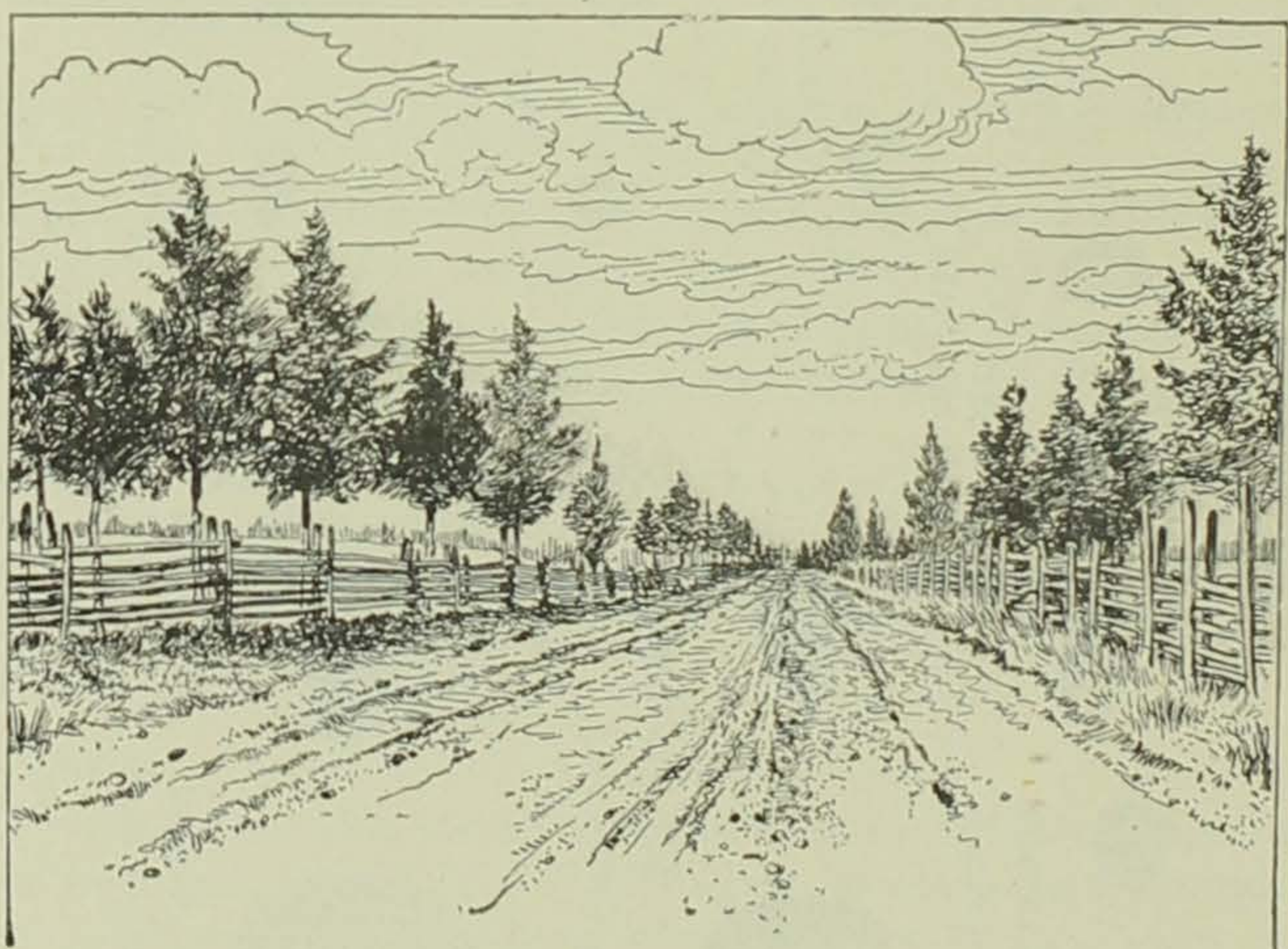


Figure 139. \* Red Cedar distributed by birds along a New Jersey road. (Pinchot-Bergen).

wild black cherry (*Prunus serotina*) are materially hastened by passing through the digestive canal of birds, and Morris states that geese are fed *Acacia arabica* to hasten germination. In a wooded country the cases of bird-disseminated seeds are more numerous than a prairie country, yet in the latter regions these agents are more readily discerned. Take the great prairies of Texas, where telegraph lines are extended through the region, or where the open prairies are being fenced, one will find such plants of the woody species, the fruits of which are carried by birds. I have seen mustang grape (*Vitis candicans*), hackberry (*Celtis*), mulberry (*Morus rubra*), cherry (*Prunus*), etc., along fences. The same thing may be seen in many other places. In our own state one observes lining the fences a variety of plants



with edible fruits. In Boone county I noted two species of dogwood, two species of *Rhus*, one poison ivy, the grape, hackberry and plum. They had formed a tangled mass. Not long ago in going through the woods a dozen or more seeds of *Smilax rotundifolia* were found on an old stump where they had been left by birds.



Figure 140. BIRD SCATTEED FRUITS. 1. Raspberry (Beal). 2. Burning Bush (*Enonymus atropurpureum*). 3. Bitter Sweet (*Celastrus scandens*). (Charlotte M King).

The poke berry (*Phytolacca decandra*), too, is a conspicuous weed in corners of fences, in Texas, Missouri and southern Illinois, and this recalls to mind that this plant was long ago introduced into southern France, cultivated at first for the dark red juice of the berries which were used to color the wines grown in the region. The berries are greatly liked by birds who have scattered the weed over France and Switzerland.

Kerner states that the seed of this plant poisoned a thrush. This is, however, not generally the case according to Weed. He states they are eaten by cedar birds, crows, blackbirds and many others.

The Red Cedar is distributed by birds. It is said that nurserymen feed the "seed" to turkey to hasten germination. Avenues and roadsides become lined with the plant. The bitter sweet and strawberry are likewise scattered by birds.

Birds destroy annually an enormous number of weed seeds. It is hard to estimate the value that birds are to the farmer in this respect. Dr. Sylvester Judd found that no less than fifty birds act as weed destroyers and plants which they eradicate number

— The Natural History of Plants. 2: 864.

— Seed Travellers. 37.



more than three score of species. Even the despised English sparrow though having grain eating proclivities consumes during the winter large quantities of weed seeds. Our native sparrows are said by Dr. Judd to have eaten three hundred seeds of pigeon grass or five hundred seeds of lamb's quarter. This bird while regarded with disfavor in the United States because it drives away insectivorous birds, and because of this insects do

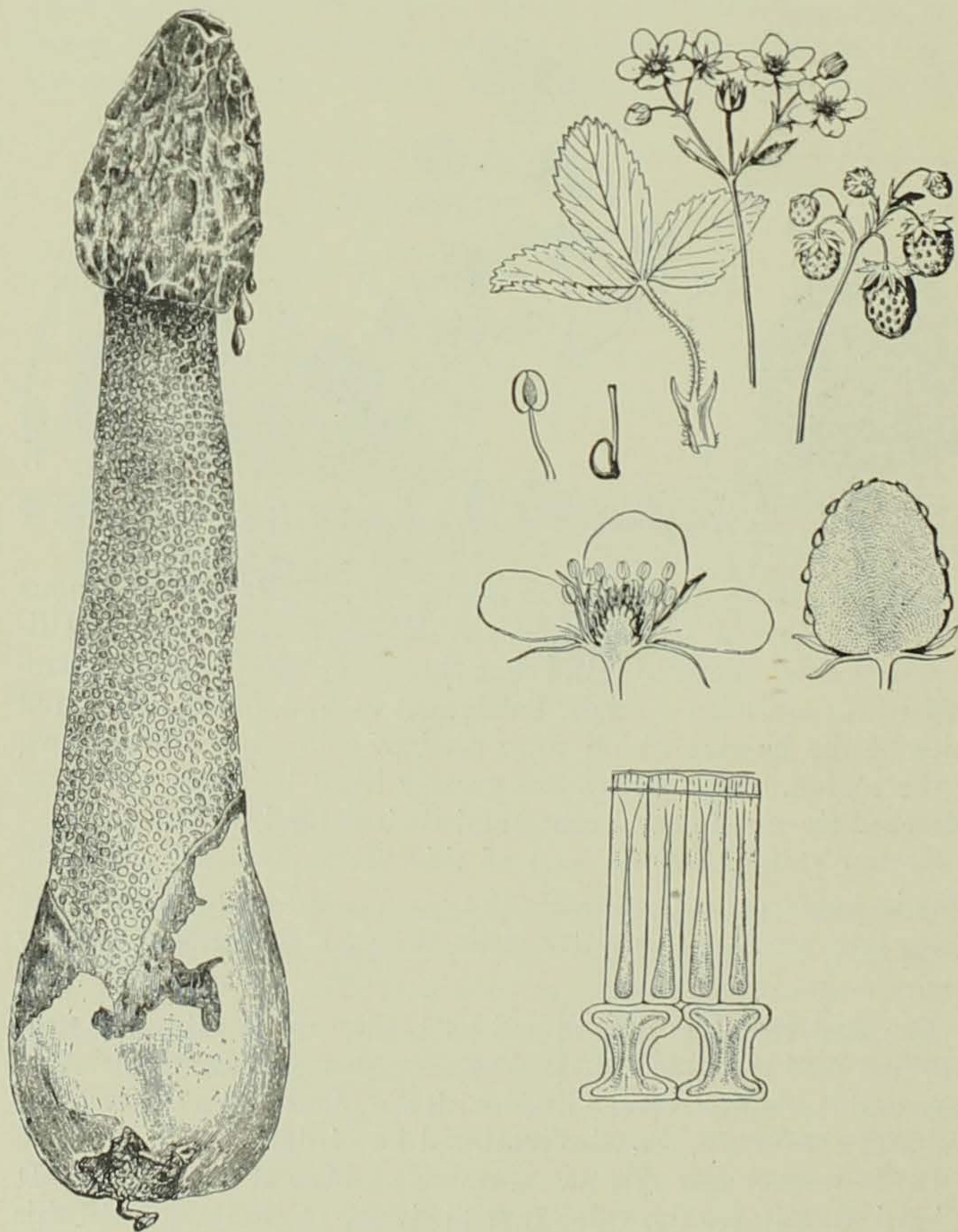


Figure 141. VARIOUS ANIMAL DISSEMINATED PLANTS. 1. Spores of Stinkhorn scattered by flies. 2. Strawberry scattered by birds. 3. The hard leguminous seeds pass the digestive tract of herbivorous animals uninjured. (1. Schenk. 2. Willis. 3. Charlotte M. King.)



much damage to corn and fruit. The stomachs have been examined to some extent by the U. S. biological survey and Dr. Judd states that during the colder half of the year the food of these birds consists almost entirely of the seeds of weeds. Even the blackbird and its allies which do considerable damage to crops, consume large quantities of weed seeds, among them the mustard, crab grass, etc. The crow blackbird is said to eat from 30 to 50 seeds of small weeds at a single meal, sparrows 100 seeds of crab grass. Dr. Judd states with reference to the dandelions that at least three-fourths of the dandelions that bloom in May on the department lawns are mutilated by birds. Prof. F. E. L. Beal who has carefully studied the food habits of the tree sparrow concluded that each bird consumed at least one-fourth ounce daily. On this basis he calculated that in the state of Iowa the tree sparrow annually destroys 1,750,000 pounds of weed seed

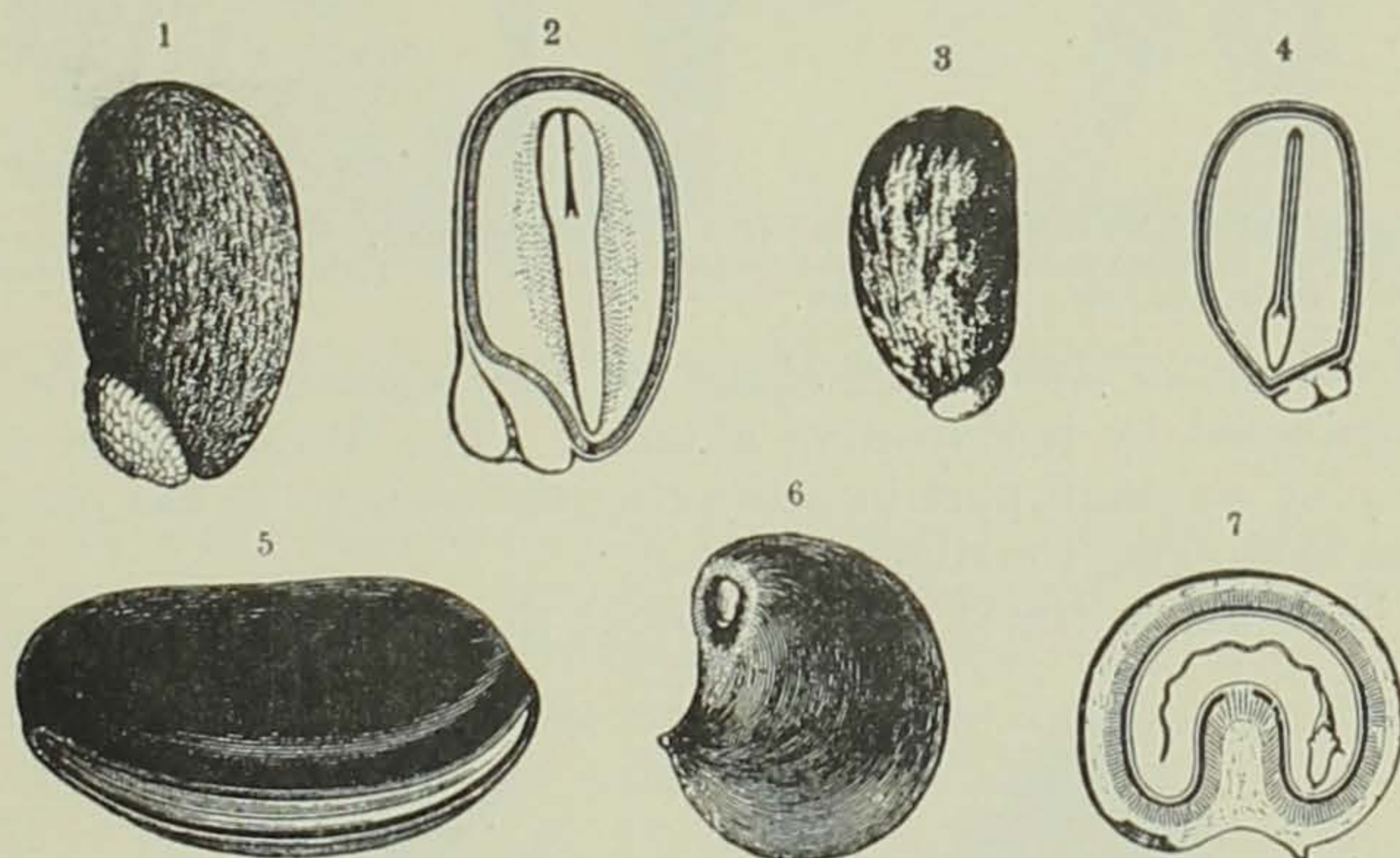


Figure 142. SOME HARD SEEDS AND SEEDS WITH APPENDAGES. 1. Common Pansy (*Viola tricolor*) with caruncle. 2-3. Castor Oil Bean. 5. Calabar Bean. (*Physoseigma venenosum*). 6. *Anamirta Cocculus* (Baillon-Kerner).

during its winter sojourn. Mr. Paul Bartsch, according to Dr. Judd, found that the common gold finch feeds entirely upon the bull thistle (*Cnicus lanceolatus*) during July. While these birds are useful in destroying large numbers of weed seeds some of them will certainly chance to be carried far from the place where they were eaten by the birds. The story is told that the so-called goose wheat which was grown by the Russians in Alaska was introduced from grain found in the crop of the wild



goose which was shot on its way to the south. And it is thought that the wild goose wheat has become a permanent settler upon the Saskatchewan. The same story is, however, repeated in other sections of our country. I was told some years ago that this wheat was introduced in a similar way in the vicinity of Manchester this state.

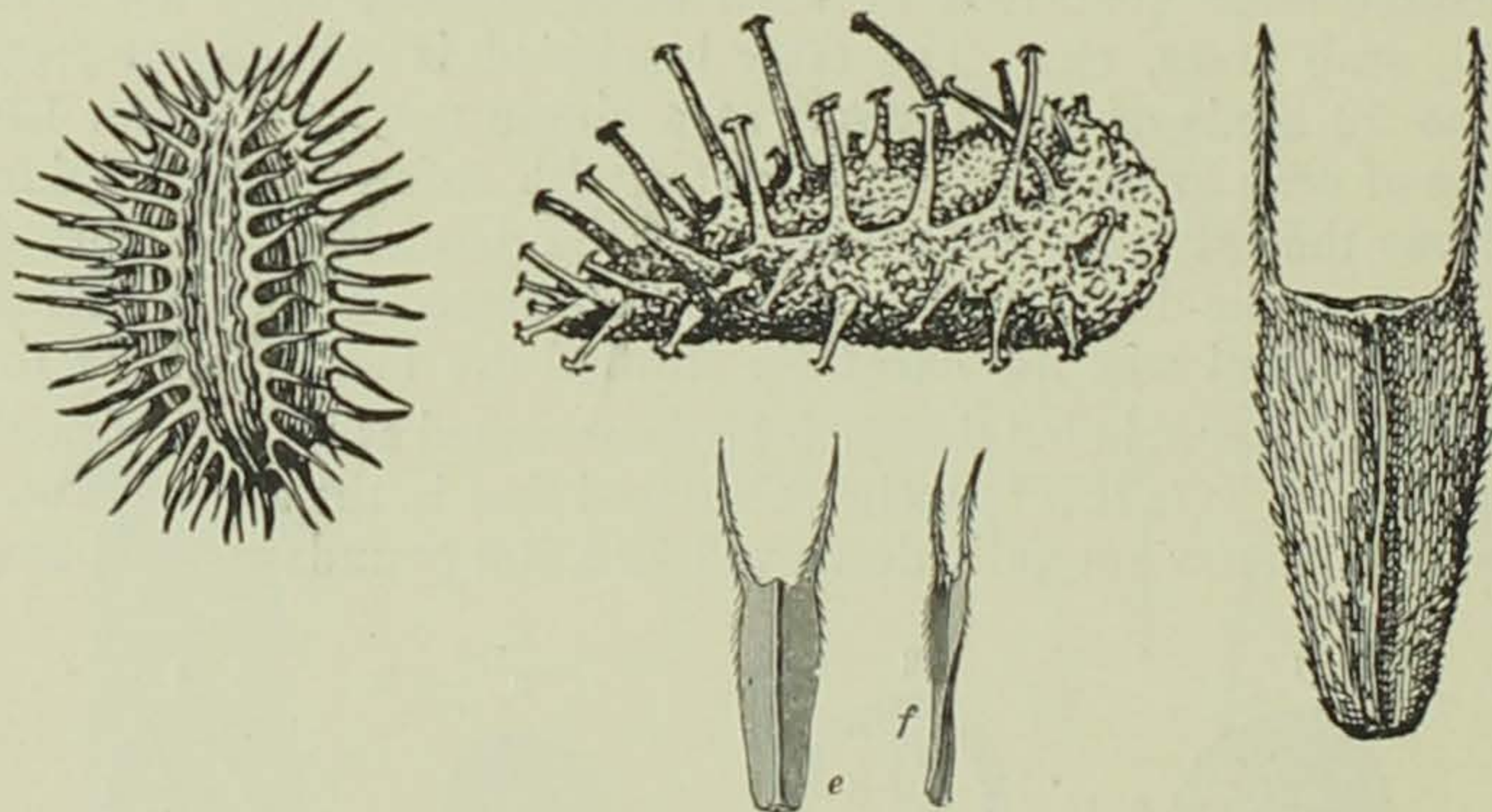


Figure 143. ANIMAL DISSEMINATED FRUITS. 1. Common Carrot (*Daucus Carota*). 2. Stickseed (*Echinopspermum*). 3 and 4. Pitchforks or Bootjack (*Bidens*) with two barbed points. (W. J. Beal).

*Herbivorous Animals.*—Many of the leguminous seeds are disseminated by herbivorous animals. The Malpighian cells here play no small part in protecting the embryo in the passage of the seed along the digestive tract.

I have many times seen cattle eat the pods of honey locust

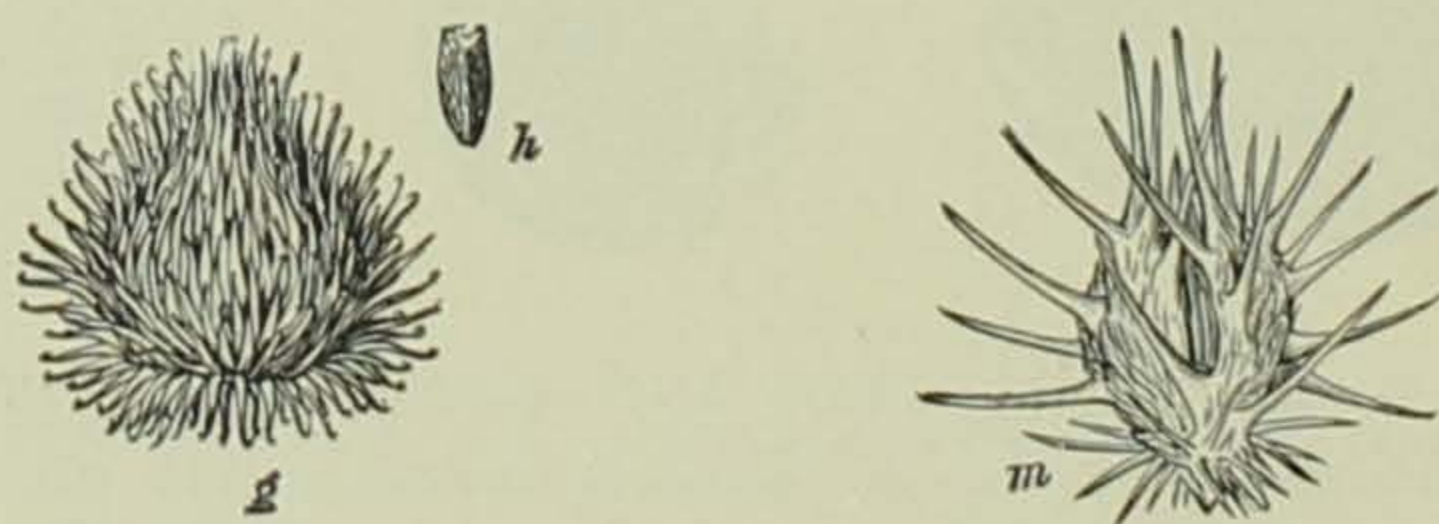


Figure 144. ANIMAL DISSEMINATED FRUITS. 1. Burdock (*Arctium Lappa*). 2. Sandbur (*Cenchrus tribulorides*).

(*Gleditschia triacanthos*). The sweet, gummy material is relished by cattle. In central Iowa it is not uncommon to find the honey locust coming up in the streets and around stables. Warder has mentioned this for *Gleditschia*. The seed of mesquite (*Prosopis juliflora*) is largely dissem-

Warder, J. A., and D. L., and Joseph F. James. Woody Plants of Ohio. 1881: 73-113.



inated by cattle, as noted by Sargent and others. Cattle feed on the pods when forage is scarce. Some farmers of Texas have proposed to plant the tree extensively so that it may be used for this purpose during the dry season. Its distri-

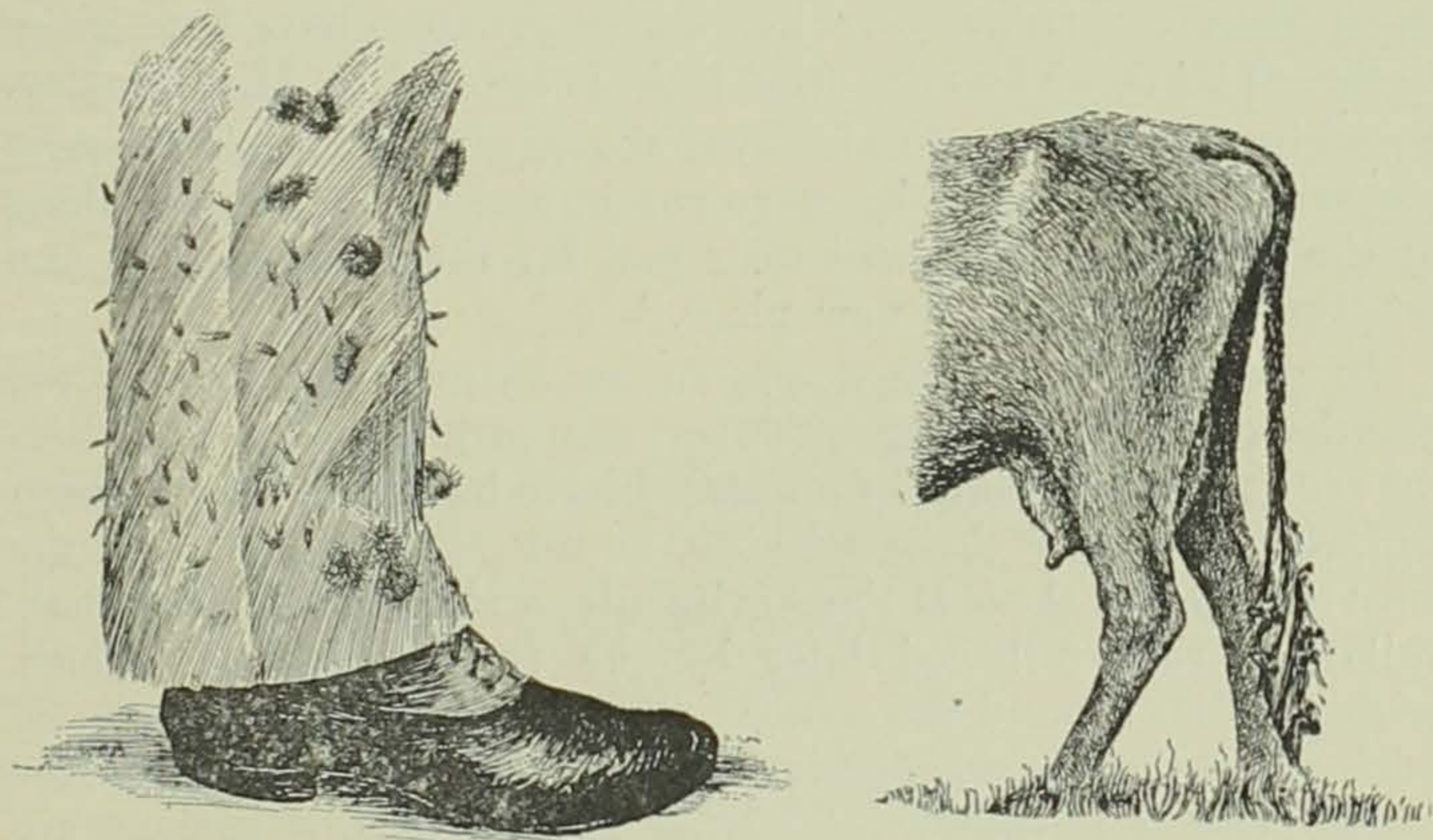


Figure 145. BURDOCK, BOOTJACKS, ETC., STEALING A RIDE. The cow an agent in scattering Burdock. (L. H. Bailey).

bution in Texas has, no doubt, been largely brought about by cattle and formerly the buffalo. The excrement forms a most suitable nidus for the germination of the seed. Dr. A. P. Anderson informs me that the seed of *Sesbania vesicaria* passes through the digestive tract uninjured.

The wide distribution of *Lespedeza striata* over the southern states is due, according to Mohr, to the excrement of herbivorous animals. I am reliably informed that the seeds of *Cassia Chamaecrista* are disseminated by sheep in southwestern Iowa. The disseminators in this instance suffered some inconvenience because of the cathartic action of the seed. Grisebach and Morris have shown that the distribution of *Pithecolobium* in the West Indies is due to herbivorous animals.

Dinter states that oxen are very fond of *Acacia giraffae*

Sargent, C. S. *Silva of North America*. 3: 104.

Mohr, Charles. *Bot. Gaz.* 3: 104.

Grisebach, A. H. R., *Flora of the British West Indies*. 789.

Morris, D. The dispersion of seeds and plants. *Nature* 37: 466-7.



and the result is that thousands of young plants spring up in gardens where the manure is scattered. From an ecological standpoint the hard cells of the seed coat of these plants certainly have a very important function to perform.

*Plants disseminated by animals because of hooked appendages or hairy coverings.*—Various common names have been given to these plants. The term stick tight is applied by Miss Morley. Speaking of their mode of travel she says, "But their favorite method of travelling is by stage coach, and if you happen along at the right time they will take you for their stage coach and let you carry them to a new place."

In going through the woods on an autumn day during the months of August and September one carries away with him the fruits of many kinds of plants. I have had more than a dozen different kinds of these sticking to my clothes. One of the most common of these is the Agrimonia, a plant producing small yellow flowers followed later by the fruit which is armed with prickles around the center. Then there is the white Geum with a similar prickly fruit. This plant belongs to the rose family and it is rather interesting to observe how various are the methods for dissemination in the rose family; in the strawberry and the cherry and the plum we have edible fruits for animal dissemination, in the *Geum album* animal dissemination by hooked appendages; in species of Geum, the *G. triflorum*, the fruit is disseminated by the wind. In *Cercocarpus* the fruit is disseminated by the wind. In many species dissemination is by gravity as in *Potentilla*.

Again a member of the Umbelliferae the Sanicula or black snake root with a globular fruit is thickly clothed with hooked prickles, and the sweet Cicely (*Osmorrhiza brevistylis*), produces an elongated linear fruit with projecting hooks. The fruit of the little sweet scented bed straw, *Galium triflorum*, is covered with stiff bristles. Another common plant in our woods is the enchanters nightshade (*Circaea Lutetiana*, L.) a plant producing small white flowers but later a small indehiscent fruit with a bur containing hooked bodies. A member of the Verbena family commonly called the lop seed because of its dry fruit, and long slender teeth hooked at the tip. On a single tramp through the woods in the autumn these may be found attached to one's clothes. There are many others dispersed by hooked

—Dinter. Gardener's Chronicle III. 22: 338.

Little Wanderers. 73.



appendages among them the sand bur and cockle bur.

In the cockle bur (*Xanthium Canadense*, Mill), the covering surrounding the "seed" is provided with hooked appendages hard to extricate when once they get into the hair of an animal. In burdock (*Lappa major*) the small leaves (bracts), surrounding the cluster of flowers are hooked. A large number of these sometimes collect in wool and hair and become annoying objects. These hooked fruits also occur in many different families. Grasses like the sand bur (*Cenchrus tribuloides*), porcupine grass (*Stipa spartea*), are scattered by animals, the latter often an annoying and a troublesome weed, working its way



Figure 146. BROME GRASS (*Bromus*). Often scattered by animals. (Scribner U. S. Dept. of Agriculture).



under the skin. In all of our woods there are leguminous plants that have received the common appellation of tick-trefoil, or stick-seed (*Desmodium*) from the fact as one passes through the woods they stick to the woolly objects. The pod which is in one piece on the plant separates into several joints. The pod is provided with hairs that are curved and thus are admirably adapted to cling to objects.

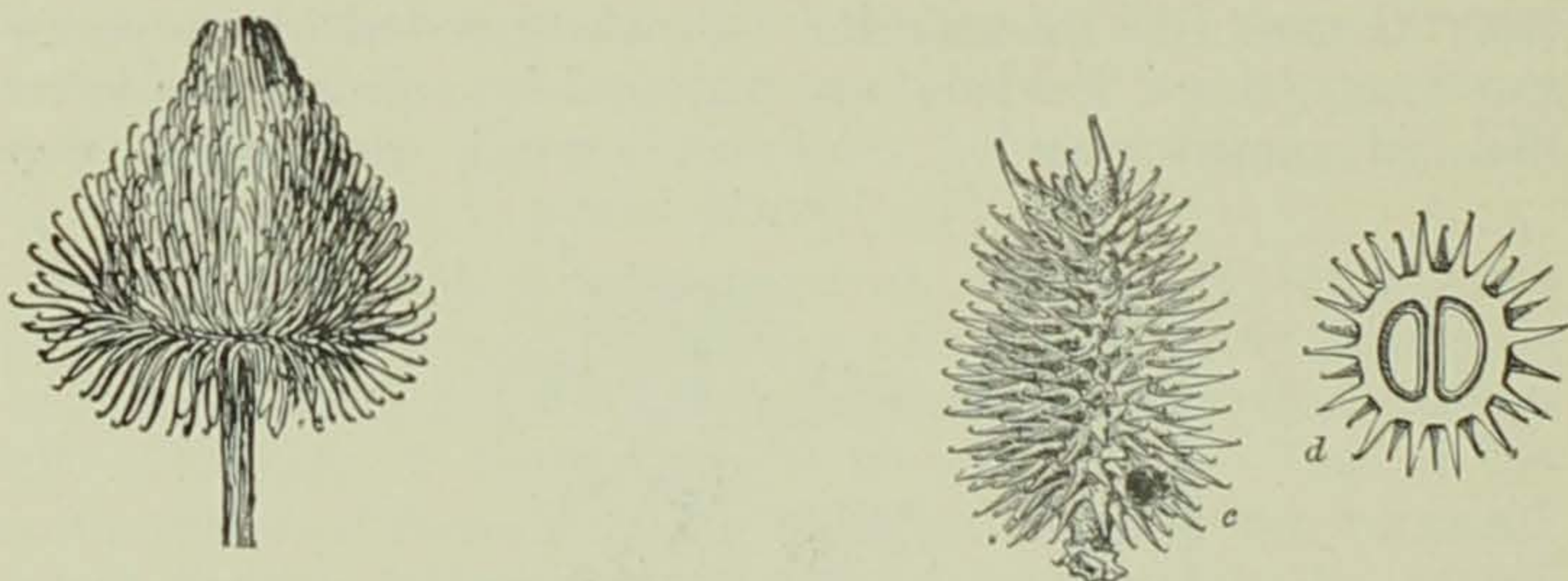


Figure 147. 1. Burdock. 2. Cocklebur. 3. Section of carrot.

Our common squirrel-tail grass (*Hordeum jubatum*) is most efficiently carried by animals. The spikes, when mature, break up into joints, and although the joints are not sharp-pointed they readily cling to the fleeces of animals. So, too, do the broken points of *Sitanion* cling to animals.

In *Streptochaeta*, says Hackel, "The ripe fruit hangs from delicate spiral threads (the awns) which are fastened together at the end of the spike; they are free below, and their soft-pointed bracts, bent outward, act like fish-hooks by catching into the fur of any animal that touches them in passing."

Then there is a weed known as beggar's tick (*Bidens frondosa*) which occurs in cultivated grounds. Other related species are common in low grounds. As one walks through these places his clothes become covered with a large number of these "seeds" that cling persistently because of the rigid awns arising from the end of the seed. These awns are provided with small barbs that point downwardly. This plant like the burdock and cocklebur belongs to the composite family.

Animals are largely responsible for the widespread distribution of the common stork's bill (*Erodium cicutarium*) which as Mr. Ball says, "has made it equally at home in the upper zones of the Peruvian Andes, in the low country of central Chili, and in the plains of north Patagonia. Its extent seems to keep pace with domestic animals, and as far as I have been able to ascer-



tain it is nowhere common except in districts now or formerly pastured by horned cattle." The *Erodium* has become equally widely scattered upon the California coast and becoming extremely abundant in the Great Salt Lake Basin, found not only in the streets but everywhere in the foothills, occupying every available waste space and no doubt taking part in the extermination of the native indigenous plants.

In our meadow grasses, well represented by common blue grass (*Poa pratensis*) the nerves of the flowering glume are clothed with cobwebby hairs which enables the fruit to be readily carried away by animals, especially sheep. Who has not observed blue grass seed clinging to one's clothes as he goes through a field of ripe blue grass? Finally a few plants pro-

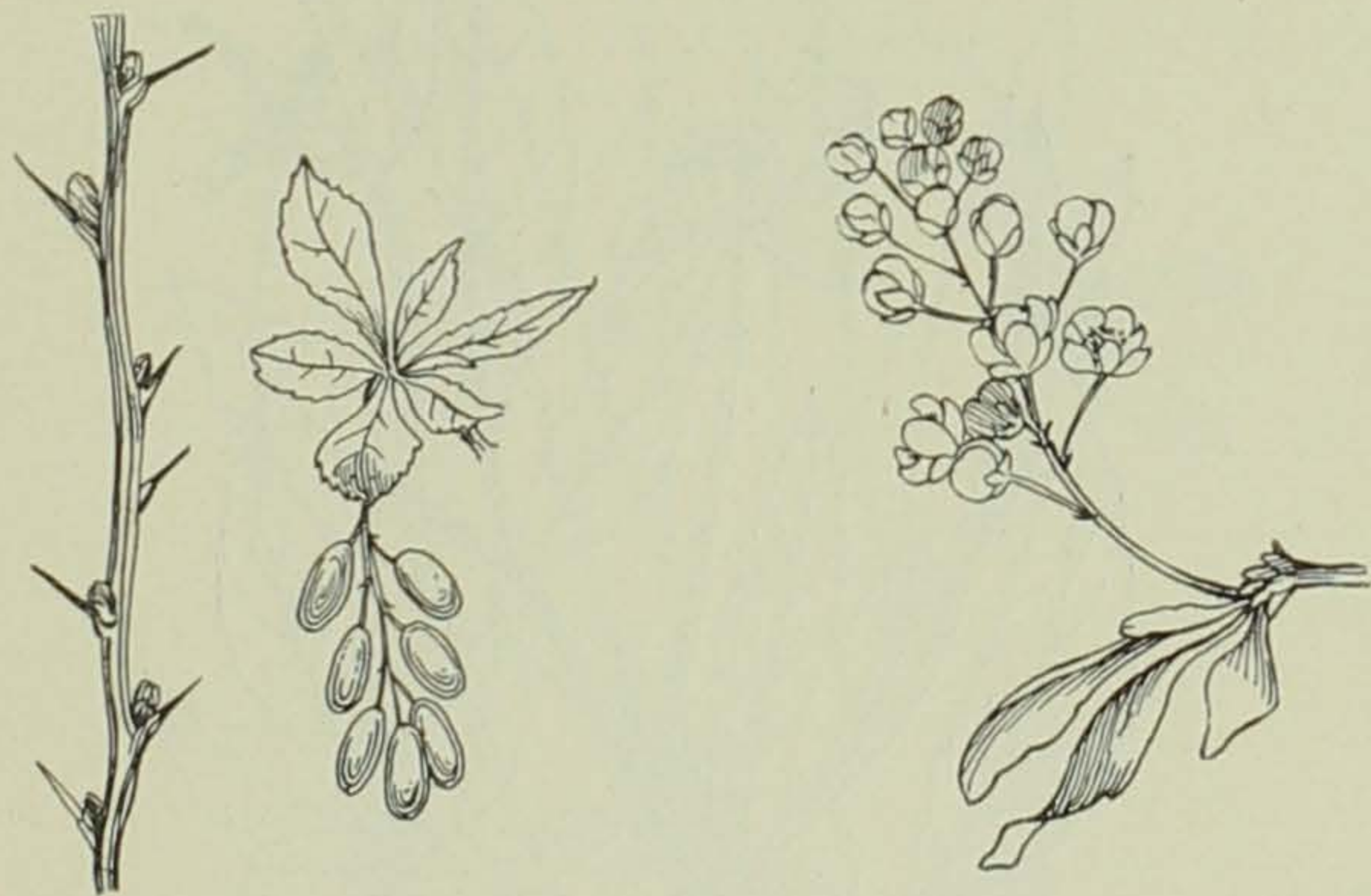


Figure 148. BARBERRY (*Berberis vulgaris*) scattered by birds. (Charlotte M. King).

duce hooked fruits that attach themselves to birds. Mr. D. Morris in an article on the subject of Dispersion of Plants by Birds calls attention to how birds disseminate certain species of sedge, *Uncinia Jamaicensis*, which grows in the damp places in the mountains of Jamaica. The sedge in question has barbed "seeds" or fruits. The plant overhangs small pools of stagnant water along the banks of mountain rivulets. The fruit bristles with long exserted rachilla each shaped something like a shepherd's crook. This hook if drawn along the back of the hand would grasp and draw out the finest hairs. This plant is found widely distributed along the track of migratory birds not only

Nature. 35: 151.



in the West Indian Islands but in Central America and Venezuela.

The Water Marigold (*Bidens Beckii*, Torr), a smooth aquatic member of the composite family, is common in our northern streams and bogs, and is disseminated probably by birds like ducks and geese. The Sticktight referred to in another connection is disseminated by animals, the grappling hooks on the achene making it admirably suited for such dissemination. The *Bidens Beckii*, like other members of this genus, produces awns that are downwardly barbed. This species produces 3-6 awns about an inch long that are barbed only at the apex, making it admirably adapted for duck dissemination. *Bidens* be-



Figure 149. A PLANT KNOWN AS PITCHFORKS (*Bidens frondosa*) SCATTERED BY ANIMALS. (Charlotte M. King).

longs to the order Compositae.

*Creeping Mechanisms and Seeds Burying Themselves.*—Kerner, the great Austrian biologist, in speaking of the creeping movements of plants says:



"The limitation of the range of dispersion is still more marked in the case of fruits which creep or hop along the ground than in those where the action is that of a sling or of a catapult. The fruits in question have stiff and very hygroscopic bristles projecting on one side from their external coats, and these bristles



Figure 150. NEEDLE GRASS (*Stipa comata*) scattered by animals often inflicting serious injury. (Scribner U. S. Dept. of Agriculture).

continually change their position according to the varying state of the environment in respect to moisture and, by so doing propel the fruit or seeds, as the case may be, in a definite direction. The awns which project from the glumes of grasses e. g. *Elymus crinitus*, *Secale fragile*, and various species of *Aegilops*; the strong bristles in which the bract-scales of the flowers in Restiaceae terminate (e. g. the South African plant, *Hypodiscus aristatus*), the calyx-bristles and stiff pappus-hairs in Scabiosus and

Kerner. Natural History of Plants. 2: Part II. 843.



Composites (e. g. *Crupina vulgaris*), and the divergent calyx-teeth in Papilionaceae (e. g. *Trifolium stellatum*) constitute structures whereof the different parts alternately approach and recede from one another and so cause a movement resembling that of creeping. In all these cases the hygroscopic structures are furnished with small teeth.

In *Avena elatior*, *Avena pratensis*, and several other grasses the awns which project from the base of the enveloping glumes are bent elbowwise. The part below the bend is spirally twisted, and as the tissue is extraordinarily hygroscopic, the spiral relaxes or contracts according to the amount of moisture in the air. This spiral motion causes the part of the awn which is above the bend to move like the hand of a watch, but now to one side, now to the other.

Even among terrestrial species there are not a few cases in which plants are not contented simply to leave their seeds on the surface of the soil, but actually to sow them in the ground.

In an English species of clover (*Trifolium subterraneum*), only a few perfect flowers are produced. The flowers that bear the seed are produced in a pointed head which is turned upward at first, but when fertilized the head bends over, grows downward, forcing the flower head in the ground. In the peanut (*Arachis hypogaea*) which has yellow flowers something like a pea, when fertilized the stalk grows forward and downward, generally forcing the immature pod in the ground. It fails to develop unless buried.

Several of our species of violet bear closed or cleistogamous flowers. During the spring the irregular flowers are produced in great quantities and during late summer or autumn especially when the conditions are favorable, that is, there being enough moisture these cleistogamous flowers are found in great abundance among the leaves although not actually buried may easily become so because the dirt washes over them in the fall. Such conditions afford convenient places for their germination.

The hog pea, *Amphicarpaea monoica*, and its related sister have adopted the habit of producing their fruit underground. This plant not only produces pods somewhat similar to other leguminous plants above ground but in addition a small one seeded rounded pod is produced underneath the ground.

As Hamilton Gibson says:

— These are the seeds that plant the soil for next year's vines, and are the fruits of queer little underground blossoms, bearing no more resemblance to those at the other end than is seen in the pods.

Miss Schnively has made some interesting observations on the hog pea (*Amphicarpaea monoica*). From her studies it seems

l. c. 167.

Cont. Bot. Lab. University Penn. 2: 20.



that the pods produced underneath the ground are somewhat different than those of the aerial type, the hard cells seem to be wanting. The seeds are, however, not strikingly different as to their Malpighian cells than the seeds produced above the ground.

There are many plants in which the fruit is buried by hygroscopic movements as in our porcupine grass (*Stipa spartea*). The cylindrical grain is provided with a sharp-pointed callus which makes it easy to penetrate clothing, the skins of animals and soil. The grain is enclosed by the hard persistent, flowering glume which surrounds the palet. The lower portion of the coriaceous flowering glume, as well as the pedicel, are covered with stiff hairs that point upwardly in an oblique direction. The flowering glume bears a strong awn twisted like a rope. This awn is very sensitive. The coils unroll or unwind when damp, and when dry they return to their former condition. Whenever this drying out takes place the points of the flowering glume are rotated with lateral variations. The upper half of the awn remains straight and soon becomes bent at nearly a right angle to the twisted part. This portion of the awn is of very material assistance when it comes in contact with surrounding objects. The bristles at the lower end prevent the seed from being pulled out. "This rotation and mutation, together with the action of the bristles, soon causes the bract surrounding the fruit to bore deeply into the ground." This boring into the soil takes place in a short time.

Beal says in speaking of the feather grass:

Francis Darwin found that the rate increases up to the fifth revolution, and then diminished quickly. In three wettings and three dryings, a little over an inch was buried in dry sand. A rise of temperature affects the awns in the same way as increased moisture; a fall of temperature acts like dryness.

Mr. R. M. Christy states that a large number of seeds are often found beneath the skin of sheep, especially about the shoulders. Dr. M. Stalker states that in many of the north-western counties of Iowa they occasioned much annoyance to sheep and, in some instances, caused the death of animals. They penetrated and buried themselves in the flesh. Dogs and even persons are affected in this way. F. H. King says that he was much annoyed by the fruit of this grass. *Stipa capillata* of southern Russia, *Aristida hygrometrica* of Queensland and *Heteropogon contortus* of New Caledonia inflict similar injuries.



Dr. Byron Halsted conducted an experiment in which the following points were observed: "In order to better understand the curving, straight awns were carefully removed from the inflorescences and laid upon white paper, their position being recorded by pencil marks. It was found that bending began at once and within fifteen minutes the tips of some of the awns were rubbing against neighboring awns which at the beginning were two inches away. Some of the awns were much more active than others, and it was observed that when two crossed each other and rubbed their respective surfaces the curving was much accelerated."

The beautiful south European grass (*Stipa pennata*) also buries itself in the soil. The long, feathery awn enables the wind to carry it away. The "seed" is small, the flowering glume has a pointed callus and above it obliquely pointed stiff hairs. As in the other species it is provided with strong, twisted awns that end in a long, beautiful feather. As the seeds are carried by the wind they eventually fall, with the "seed" end to the ground, as it is heavier at the lower end. The "seeds" remain in this position as long as dry, but when moist the spirally twisted awn unwinds the plume and helps to hold it in the soil; thus, finally, the "seed" is buried in the ground.

Several species of *Avena*, *A. barbatum* and *A. fatua*, our wild oats, are similarly provided with twisted awns that help to bury the seed. Several species of *Aristida* also bury themselves, as do members of the genus *Danthonia*. In *Triticum ovatum* the entire spike falls off. It possesses a very pointed base, and the numerous rough awns pointed outward, thereby movements of the wind exert a pressure upon the point which drives it into the ground.

The peculiar use of the awns of *Avena sterilis* are described by Hackel as follows:

"Two strongly awned fruit-bracts fall off, fastened together; in moist surroundings the twisted awns begin to rotate their diverging upper halves, consequently they cross and press against each other until the bracts are forcibly separated, thus giving the fruit an impetus which throws it off for some distance.

In the *Erodiums*, which are related to the wild geraniums, the fruit is a capsule; running up through the center is a long receptacle. In some cases the upper part of the

Bull. Dept. of Bot. Ia. State Agrl. College. 1888.

Bessey, C. E. Bull. Dept. Bot. Ia. State. Agrl. College. 1884: 117.

Hackel. True Grasses.



receptacle becomes hairy as in the feather grass of Europe. The seeds are small and hairy, producing a hairy twisted awn. Near the lower part of the ovary there are a number of hairs and below this point it is spirally twisted. In the *Erodium glaucophyllum* there are hairs which point obliquely upward. The awn is very sensitive to moisture. It twists when dry and untwists when moist, and as Lubbock says, "and its extremity thus may be so arranged as to move up and down like a needle

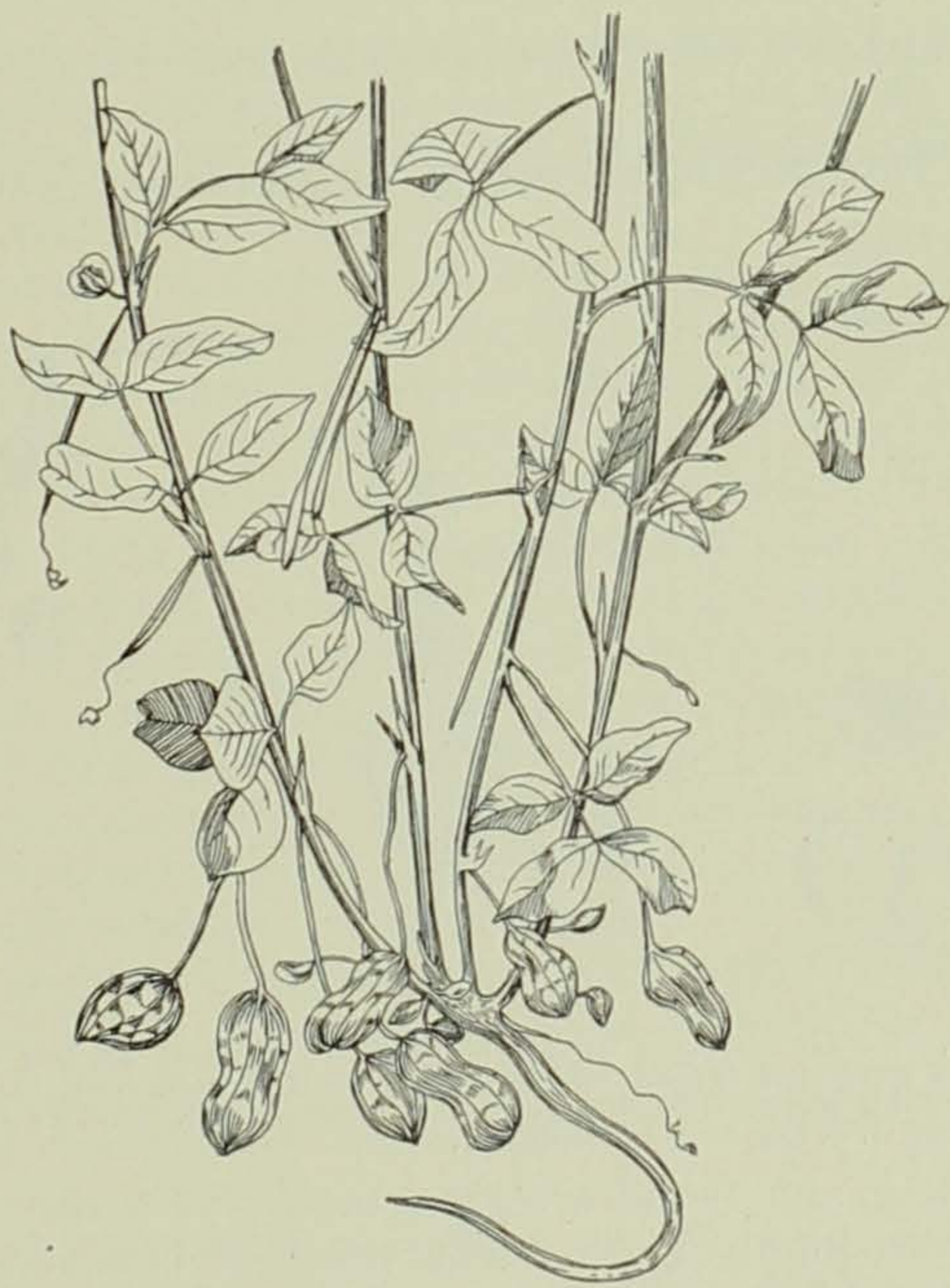


Figure 151. PEANUT (*Arachis hypogaea*) with the flowers in the axils of the leaves and with the buried pods. (Weaver and Charlotte M. King).

on a register." From the experiments made by M. Roux with another species as quoted by Lubbock, the seeds were actually buried. A species of Anemone, *A. montana*, has the same arrangement for burying itself. Here then we have representatives of three orders, the *Graminae*, *Geraniaceae* and *Ranunculaceae*, in which seeds have developed structures for burying themselves.

Flowers, Fruits and Leaves. 88.



The Rose of Jericho remains closed during the long drouth which follows the formation of the fruit and not till the winter rains set in does it open up and permit the seeds to escape. In the *Mesembryanthemum*, plants that are found in dry regions, some of which are naturalized on the Pacific coast, and frequently cultivated under the head of ice plants, produce a fruit which remains closed in dry weather, but when they are moistened the valves covering the sutures open and the seeds are exposed, being washed out by the rain.

### EXPLOSIVE PROPERTIES OF FRUITS.

*Sling fruits.*—Kerner has given the name sling fruits to those



Figure 152. 1, Pods of Wood sorrel; b, pods; c, transverse section of pods enlarged; d, outer seed coat turned inside out; e, seed thrown from the outer coat. 2. f, fruit of small flowered Geranium; g, same enlarged. 3. Pod of the common Vetch. (Dewey, U. S. Dept. of Agriculture).

in which when the fruits are ripe, the tissue surrounding the seeds becomes highly tense. The tissue is broken at several points, followed by a sudden contraction of the segments. They may double back or roll up expelling the seeds.

In balsam, jewel weed or touch-me-nots the pods spring open at the slightest touch when ripe, throwing the seeds for some distance. In *Oxalis* the seeds are also thrown out forcibly, only the tension in this case lies in the outer seed coat. When the seed is ripe the inner portion of the seed coat is in a state of tension, the cell walls swell; the outer wall being unable to stand the pressure is thrown out through a slit exposing the



outer colorless coat and brown seeds scattered for several feet. The squirting cucumber (*Momordica Elaterium*), indigenous to southern Europe, when ripe the slightest touch is sufficient to remove it from the plant. The seeds are thrown out a distance of several yards with the viscid fluid. In the violet there are three valves which when mature fold lengthwise. These valves are boat-shaped with a thick keel. Inside of each valve are the two rows of seed. The drying of the valves causes them to approach and to forcibly eject the seeds. In many of our Leguminosae the pods burst in a spiral fashion. Prof. Beal in speaking of the Chinese Wistaria says:

The two half-pods being ready to coil and spring in opposite directions; when the valves can no longer hold together, they snap with a sharp noise and sling the heavy seeds, giving them a good send-off into the world.

"This separation depends on certain cells in the hard layer. Our vetches and beans and Cassia show the same condition. The seeds as I have shown in *Mucuna*, however, are as follows: The basal part of the funiculus consists of very large thin-walled and highly turgescient parenchyma cells. Immediately above the tracheid island and below these turgescient cells, a few layers of narrow, elongated, and much smaller parenchyma cells occur, which undoubtedly are the conducting elements. Now what takes place during the ripening period? The contents of the parenchyma elements are discharged, the thin-walled, turgescient parenchyma cells collapse, and the funiculus is practically separated from the seed. The final process of complete separation occurs when the pod contracts, owing to drying out. The arillus falls in and helps to pinch the seed off. This pinching-off process is especially marked in the funiculus of *Pisum*. In *Mucuna pruriens* the pinching-off process is similar, although due to the aril.

Many of the Euphorbiaceae have explosive fruits. The seeds of the castor oil bean (*Ricinus communis*), violets (*Viola*) by a contraction of the walls of the ovary. In Hura nut (*Hura crepitans*) the seeds are forcibly thrown out of their pods. They are scattered for twenty or thirty feet around the plant."

The larger seeds are thrown further than the smaller seeds as shown by Kerner.

Name of plant.	Shape of Seed.	Range of Projection in Meters.
<i>Viola canina</i> .....	oval.....	1.0

— Beal. Seed Dispersal. 58.

— Kerner. Natural History of Plants. 2: 839.



<i>Geranium palustre</i> .....	cylindrical .....	2.5
<i>Hura crepitans</i> .....	lenticular.....	14.0
<i>Bauhinia purpurea</i> .....	lenticular.....	15.0

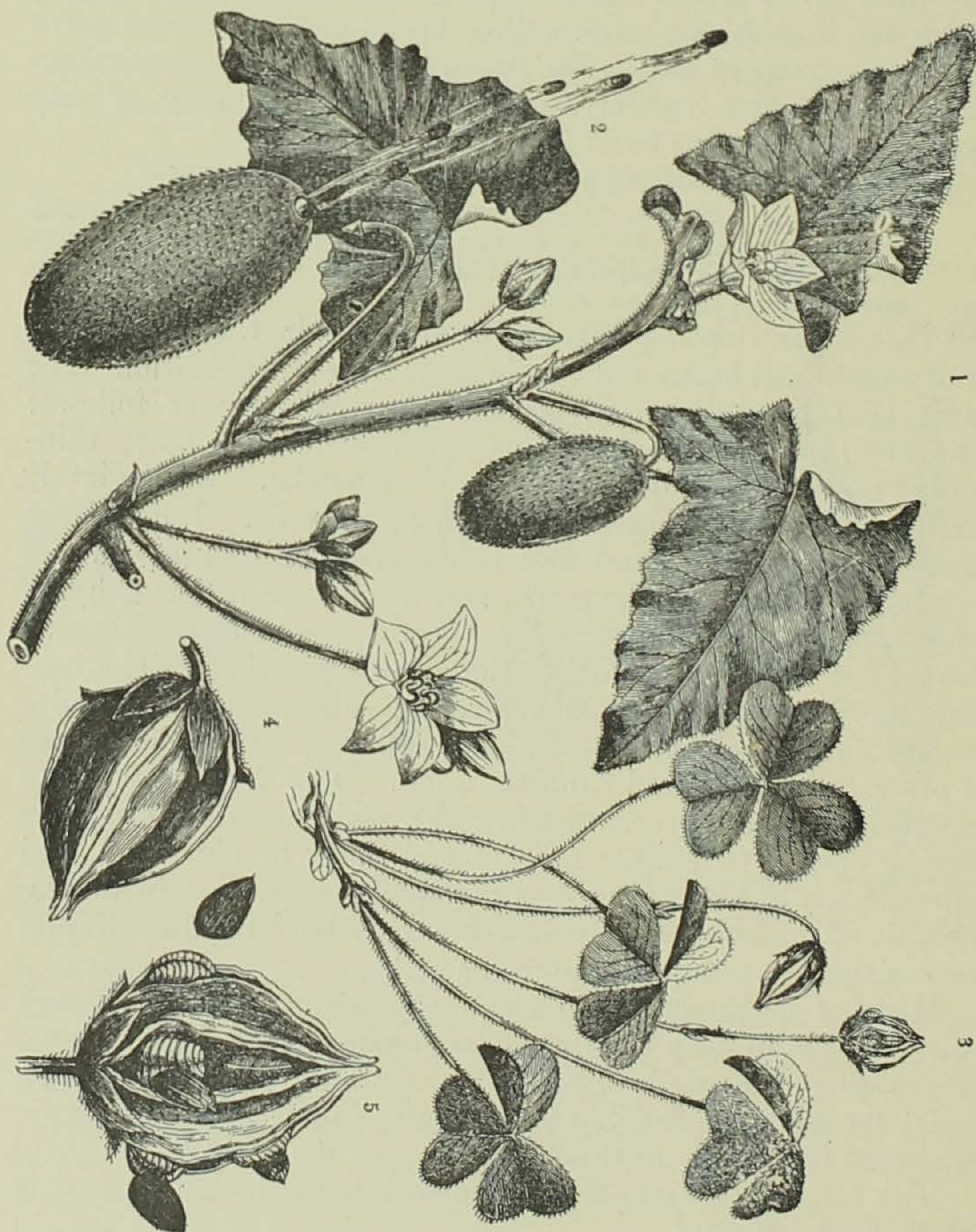


Figure 153. EXPLOSIVE PROPERTIES OF FRUITS. 1. *Orobus vernus* a member of the pulse family. 2 and 3. A common *Geranium* of Europe (*Geranium palustre*). 4. A Violet (*Viola elatior*). 5. One of the mustards (*Cardamine impatiens*). 6. Touch-me-nots or Balsam (*Impatiens noli-tangere*). 7 and 8. *Acanthus mollis*. 9 and 10. Castor Oil Bean (*Ricinus communis*).



MacDougal a few years ago described the method of seed dissemination in *Arceuthobium robustum*.

The single seeded berries are borne on short stalks which are joined to the stalk by the scission layer which is ruptured by the slightest touch, or it may burst by the tension found in the berry. The seeds are shot for a considerable distance. Dr. MacDougal says:

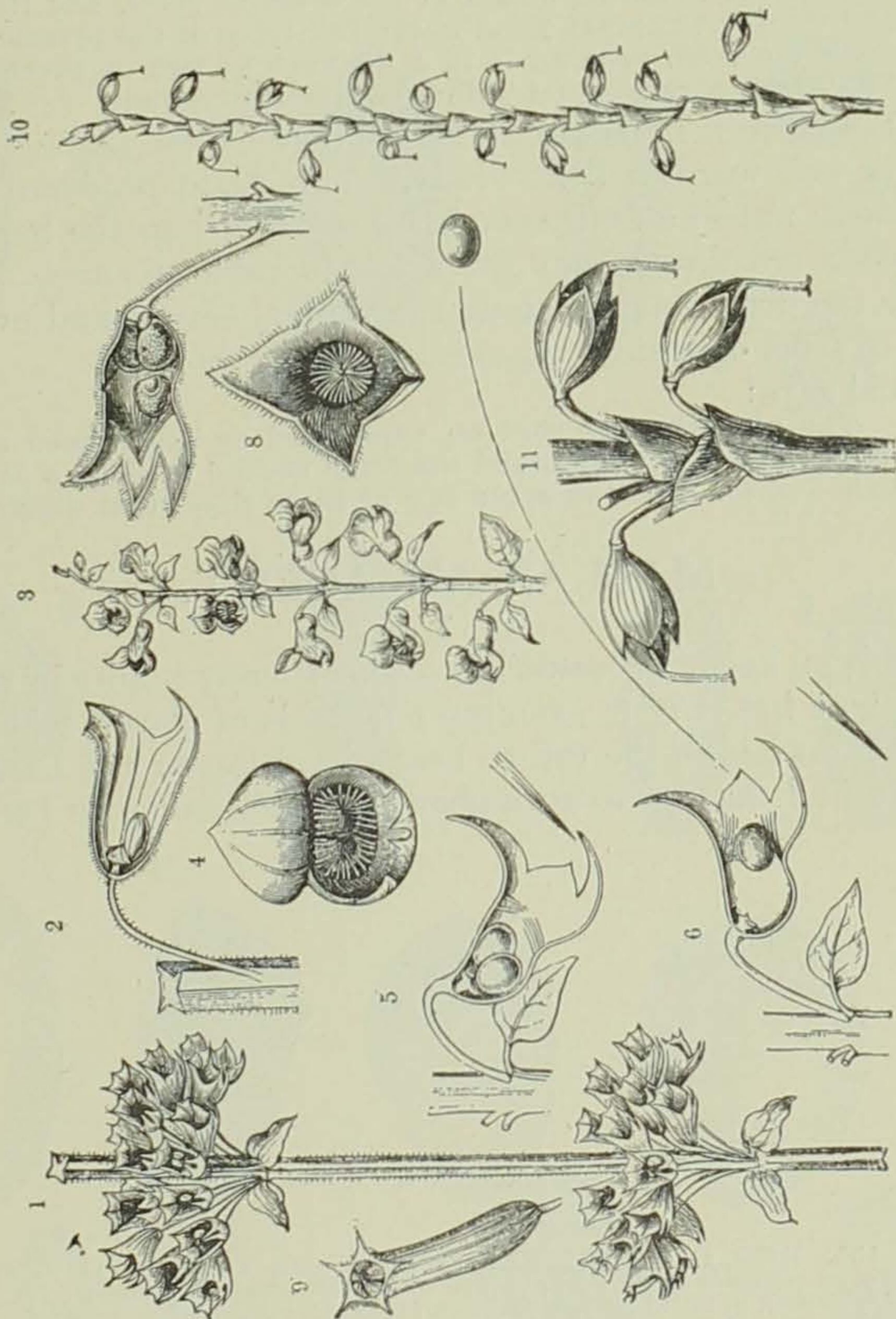


Figure 154. EXPLOSIVE SEEDS. 1 and 2 sage (*Salvia verticillata*). 3, 4, 5, 6 a species of mint (*Tenacrium Eugandaeum*), 7 and 8 *Tenacrium flavum*, 9 *Monarda fistulosa*, 10 and 11 one of the smartweeds (*Polygonum Virginicum*). (Kerner-Oliver).

The seed has the form of a modern rifle bullet, conical at  
Minn. Botanical Studies Part II. 169.



the basal end and truncate at the apical end, with a general cylindrical outline. The scission layer appears to cut into the mucilaginous layer or at least very nearly so in the mature berry. During the ripening period the contents of the expulsory layer undergo such chemical changes as to give the contents a very high isotonic coefficient. The consequent osmotic attraction of water into this layer sets up a turgescence which could not be measured, but which probably amounted to many atmospheres. The steady increase of the turgidity of the expulsory layer brings the tension to the breaking strain of the scission layer, and its sudden and complete rupture permits the full force of the pressure to act upon the seed, sending it to a distance of two or three meters. The entire arrangement is that of a mortar cannon.

In the eastern northern states a plant by the name of witch hazel is well worth a little study. This plant produces a hard and woody nut-like fruit somewhat smaller than the hazel nut. The seeds are thrown out for a considerable distance. When mature the dehiscence is along the ventral suture and owing to pressure from both sides the smooth seed is shot out.

Dr. Beal says:

The girl who has shot an apple seed or lemon seed across a small room, can understand the force needed to shoot a seed very little heavier than the apple two or three times that distance.

## MAN AS AN AGENT.

Man is an agent in scattering seeds of many plants in various ways. One has only to examine our fields of clover, wheat and oats, our roadsides, the refuse heaps in cities, or the back door yards to find that quite a number of plants unknown before in

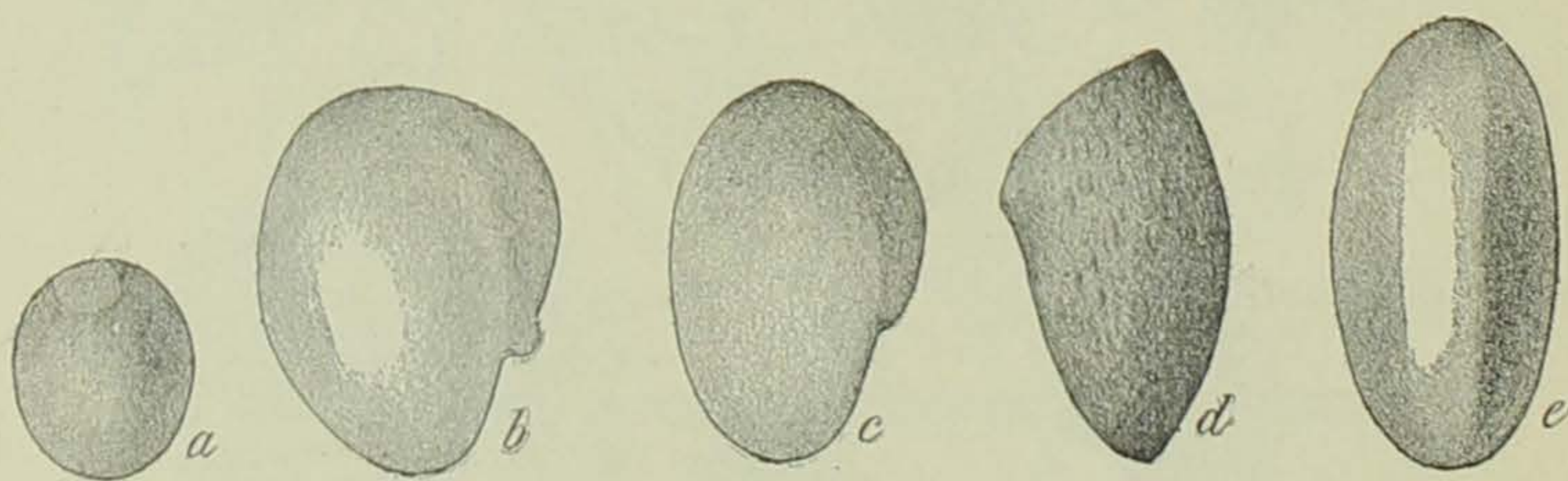


Figure 155. RED CLOVER SEED AND SOME OF ITS IMPURITIES. a. Dodder seed (*Ouscuta arvensis*) b, yellow trefoil (*Medicago lupulina*) c, red clover (*Trifolium pratense*), d, broad leaved plantain (*Plantago Rugelii*), e, buckhorn or rib grass (*Plantago lanceolata*). (U. S. Dept. of Agriculture)

the vicinity have made their appearance. We may therefore consider this topic under the following heads: First, impure seeds; second, common carriers; third, nursery stock and flowers; fourth, plants grown for ornamental purposes



*Impure seed.*—This subject is especially important from an agricultural standpoint, as many of our troublesome weeds are introduced with seeds of various kinds. No one questions the utility of making an examination of agricultural seeds to discover the impurities that are found in the way of weed seeds. This question is so important that long ago Nobbe of Tharandt, Germany, undertook an investigation of the seed question not



Figure 156. TIMOTHY AND SOME OF ITS IMPURITIES. 1. Timothy. 2. *Lepidium Virginicum*. 3. *Potentilla Norvegica*. 4. *Rumex Acetosella*. 5. Ox-eye daisy. 6. Ribgrass. 7. *Verbena hastata*. 8. Witch grass. 9. *Panicum sanguinale*. 10. *Cuscuta Trifolii*. (Hicks, U. S. Dept. Agriculture).



only from the standpoint of viability but for the impurities, so that now many of these seed stations have been established in different parts of the world, not only in Europe, but in Brazil, Japan and Java, and our own government at Washington is testing the seeds that are sent out to farmers.

Mr. C. R. Ball makes the following statement:

Seeds are tested for purity and vitality. For the smaller and lighter seeds a sample of 100 grams weight (about  $3\frac{1}{2}$  oz. avoirdupois) is required, but for the larger, heavier seed it must be 250 grams. The fees vary according to the completeness of the test. For testing vitality the fees vary from 75 cents to \$2.50 according to the size and character of the weed. For specifying the impurities the fees run from \$1.25 to \$6.25, with additional charges for determining dodder in clover seed. When the test is completed a report is sent to the customer stating the percentages and nature of the impurities and the percentages of vital seed.

The seed control station at Zurich, Switzerland, may be taken as a type of the higher grade of efficiency reached by these stations. It has an international reputation, and is largely patronized by seedsmen in the other countries of Europe, as they prefer it to those of their own countries. All persons offering seeds for sale in Switzerland are required by the federal law to have them tested at the Zurich station, and to place upon each package the percentage of maturity and vitality as determined by the station test.

In this country quite a number of the agricultural experiment stations have concerned themselves with the matter of testing seeds. Of these investigators we may quote Jenkins, Beal, Ledoux, McCarthy, Ball, Stewart, Hillman, Rolfs, Harvey and Pantan.

The United States Department of Agriculture in the Division of Botany established a section known as the Pure Seed Investigation. The first extensive government work in this country was carried on by the late Gilbert H. Hicks, followed later by the work of Pieters with a corps of assistants, among whom we may mention Hillman and Brown.

In 1891 the writer called attention to the abundance of certain weeds making their appearance in clover fields.

Prof. Beal says:

Rib-grass or lance-leaved plaitain is becoming common in clover seed. While it is not the worst of weeds the seeds are difficult to separate from those of clover, and when present must injure the sale of clover seed.

Biennial Rept. Ia. State. College Agri. & Mech. Arts. 17: 173. Cont. Bot. Dept. 9: Purity and Vitality of Grass Seed. Bull. Ia. Geol. Survey. 96.

Bull. Ia. Agri. Exp. Sta. 13.



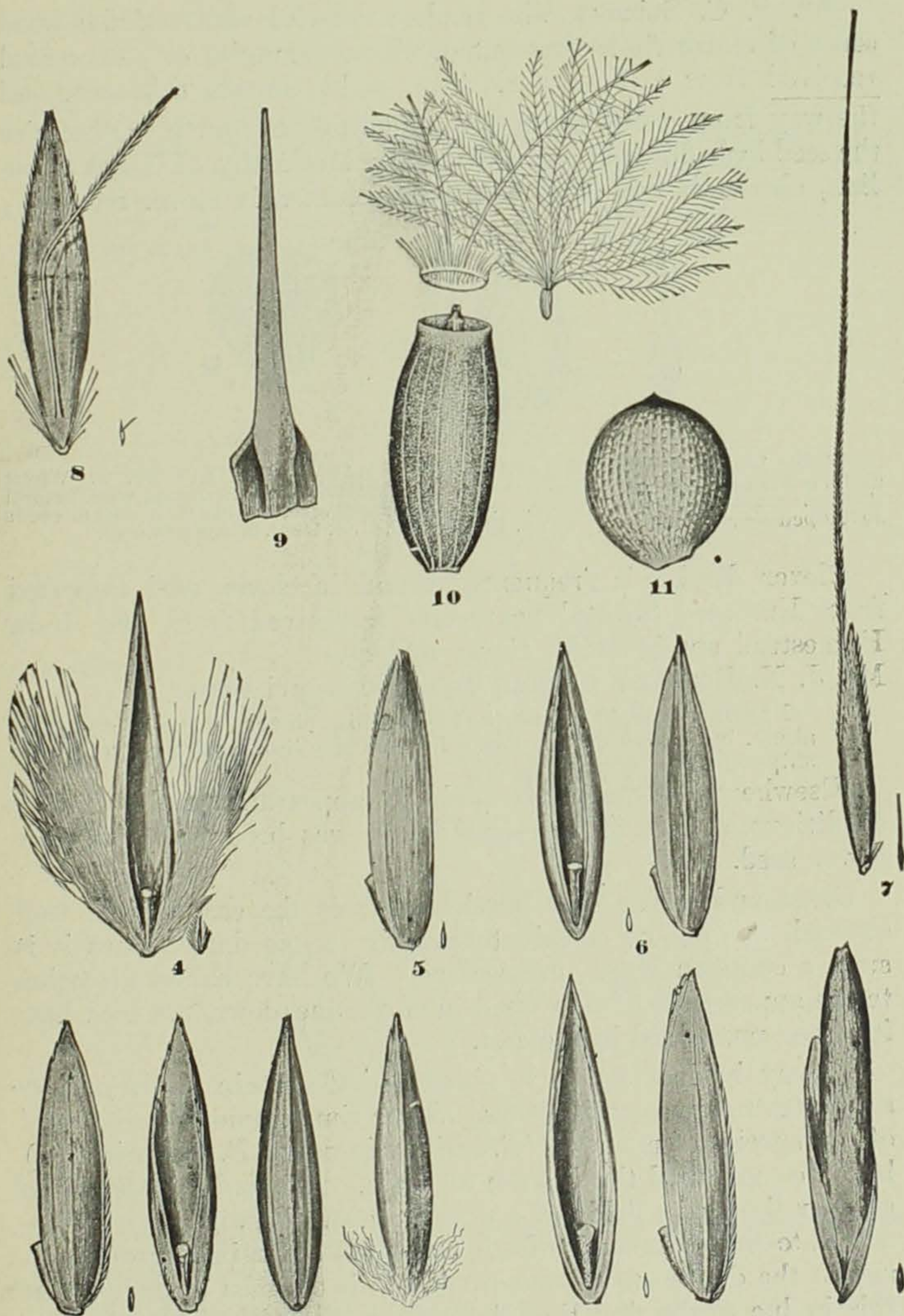


Figure 157. SEEDS OF POAS WITH IMPURITIES. 1, Kentucky blue grass rubbed and unrubbed. 2, wood meadow grass (*Poa nemoralis*). 3, ergot fungus. 4, Texas blue grass (*P. arachnifera*). 5, Canadian blue grass (*Poa compressa*). 6, rough stalked meadow grass (*Poa trivialis*). 7, silky bent grass (*Apera spicaventi*). 8, wood hair grass (*Deschampsia flexuosa*). 9, spine of Canadian thistle. 10, Canadian thistle. 11, Caryopsis of stink grass (*Eragrostis major*).



Mr. F. C. Stewart, who made a careful study of the weed seeds of clover finds that out of sixteen samples of clover seed received from a New York firm, eight contain this weed, all the way from a few seeds to considerable amounts. Otherwise the seed looked bright and clean. Mr. McCarthy, of North Carolina, also finds this weed seed very common in clover seed.

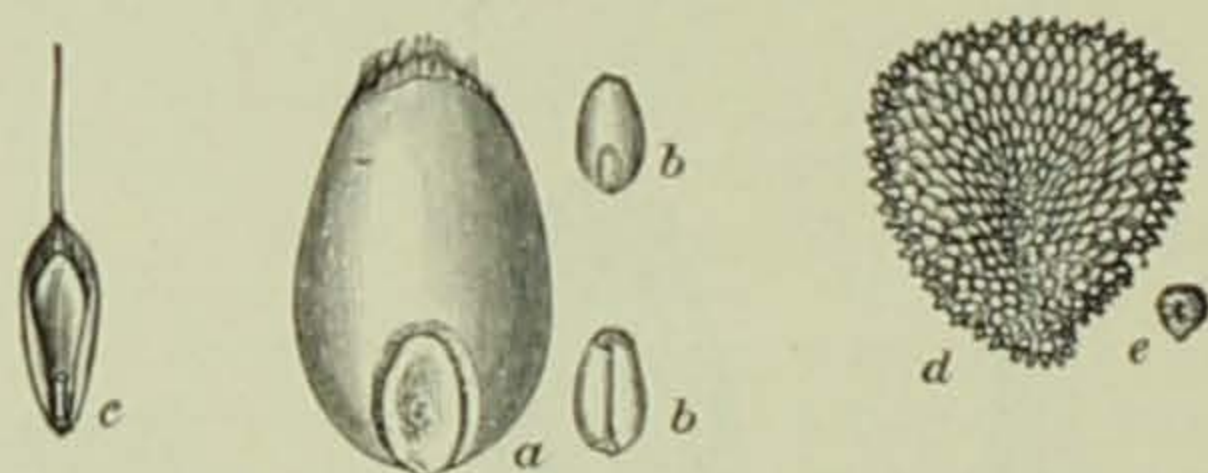


Figure 158. WHEAT AND ITS MOST COMMON IMPURITIES. *a.* Wheat grain, enlarged. *b, b.* Same, natural size. *c.* spikelet of chess, inclosing seed, natural size. *d.* Seed of cockle, enlarged. *e.* Same, natural size, smaller than cockle seeds developed by cultivation. (Dewey, Div. of Bot., U. S. Dept. of Agriculture).

Clover dodder is frequently found in clover seed imported from Europe. Several years ago I received from the Iowa Homestead specimens of clover dodder.

Mr. J. N. Downing, of Hall Town, Missouri, says:

I send sample of a vine that is killing clover, not on my farm alone, but it has quite a start in this section, and all from seed shipped here last spring.

Elsewhere this weed has made its appearance under similar conditions, and in all cases, no doubt, was brought in with the clover seed.

Grass and clover seed purchased from the east, unless well cleaned, are almost certain to contain ox-eye daisy, since it is such a common weed in meadows. We have called attention to the appearance of this weed in clover meadows, the seed having been purchased in the east.

It may be interesting to observe that certain seeds universally accompany certain crops. Since time immemorial several of our species of mustard (*Brassica nigra* and *B. Sinapistrum*) have accompanied the culture of grain. It is only necessary to go over the grain fields of northern Iowa, Wisconsin and Minnesota to find that some of our mustards occur in large quantities to the detriment of the crops. It is claimed by many that this is due to the fact that these fields have been used for the cultivation of flax and that flax is really responsible. I have seen oat seed in which at least 5 per cent was mustard. Oats is commonly much lighter than weed seeds and hence more diffi-



cul to clean than are other cereals. Dewey says oats are responsible for nearly as large a distribution of weeds, and speaking of the mustard he says:

Wild mustard (*Brassica Sinapistrum*) is common and increasing in spring wheat from New England to Oregon. Small shot-like seed of the mustard may be readily separated from the oat were it not that the mustard pod is often broken by the threshing machine into segments which retain the seed and which are about the same size and weight as the oat grain.

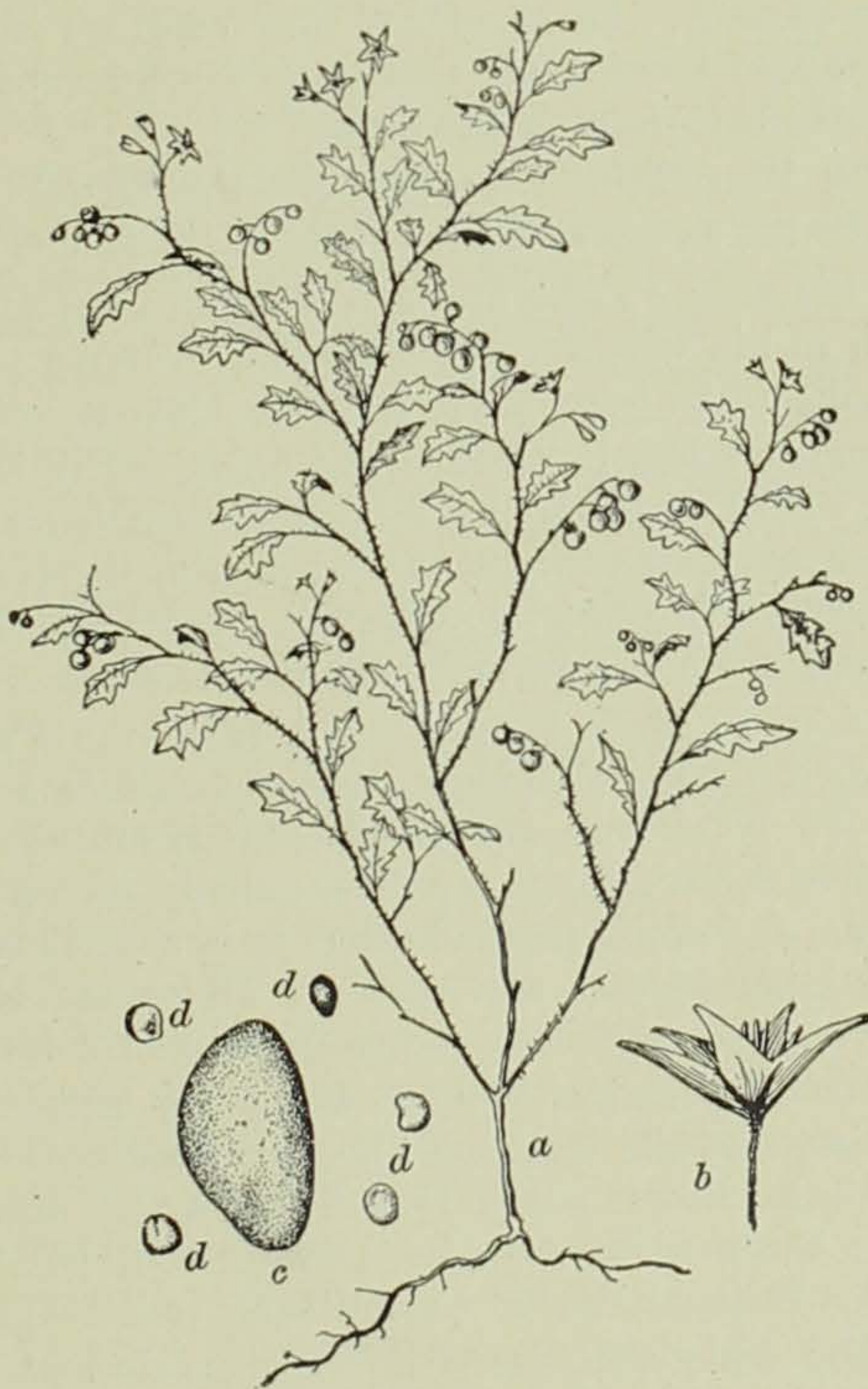


Figure 159. HORSE NETTLE (*Solanum Carolinense*) a southern weed. This southern perennial weed has moved northward to Wisconsin and northern Iowa. (Dewey, U. S. Dept. Agriculture).

We might mention further that the corn cockle (*Lychnis Githago*) is abundant throughout the wheat growing districts of the country, especially the north. Mr. Dewey finds that quite unintentionally on the part of the farmer there is developed a

Yearbook U. S. Dept. Agrl. 1896: 277.



strain of cockle with large seeds. He says:

Cockle (*Agrostemma Githago*) is found in wheat, especially throughout the north. Cockle seeds are normally somewhat smaller than wheat grains. In some parts of the northwest, where wheat for sowing has been cleaned year after year by steam cleaners, all the cockle seeds except the largest ones have been removed, and these have been sown until a large-seeded strain of cockle has been bred, which is very difficult to separate from wheat.

Different weeds are carried in agricultural seed in other sections of the country. In Maryland and Virginia it is said that bulblets of the wild onion are present in considerable quantities and frequently injurious to the flour.

As another illustration we might cite the darnel. This plant was known to the ancients for it is said in Matthew, "But while man slept, his enemy came and sowed tares among his wheat." John Smith in his work on Bible plants, referring to this plant states that the tares here must refer to Darnel, but the plant commonly called tares in Europe and occasionally in this country is *Vicia sativa* which is also found in grain fields. In many of the wheat growing sections of California, the Rocky Mountain, and parts of Minnesota, Wisconsin, Iowa and even in Illinois, wild oats are common and very troublesome. Mr. Dewey states that four of these species occur upon the Pacific coast. One, indeed, has become widely scattered and is a useful forage plant. In Wisconsin and the Rocky Mountain region the writer has found but a single species, namely *Avena fatua*. So abundant has it become in fields that it is a serious detriment to the cultivation of oats and wheat. There can be no doubt that commercial oat seed is in part responsible for its scattering.

As another illustration of how weeds are carried by farm seeds, mention may be made of the introduction of Russian thistle in South Dakota about 1873-1874, a full account of its introduction being given by Mr. Dewey in a bulletin of the United States Department of Agriculture. And since then the plant has been widely scattered by farm seeds and its tumble habit.

Our common pepper grasses (*Lepidium apetalum* and *L. Virginicum*) are widely distributed by means of timothy seed. Mr.

Yearbook U. S. Dept. Agrl. 1896: 267.

Matt. XIII: 25.

26.

l. c. 227.

Bull. U. S. Dept. Agrl., Div. of Bot. 15.



Dewey says, "English grasses were grown at Springfield, Massachusetts, as early as 1658 and some introduced European weeds were recorded soon afterward." In 1672 Mr. Josselyn gave a list of such plants. This list included couch grass, Shepherd's purse, sow thistle, dog fennel, and burdock.

*Common carriers.*—Weeds are commonly found along roadsides left there by carriers. Formerly when farmers had to go a long distance to market, chess frequently appeared along roadsides as well as many other weeds.

Who has not seen chess coming up in wheat fields? Farmers have often asked the question, Where does the chess come from? They believed that wheat turned into chess. If the chess was not in the land it was certainly brought in with the seed.

Who has not observed other weedy plants like the prickly lettuce, plantain, which as Mr. Dewey says:

The common dooryard plantain (*Plantago major*), although native in British America, as well as in Europe and Asia, was evidently rare in the United States before the coming of Europeans. The Indians called it the "white man's foot" because it seemed to spring up wherever the white man went. Our introduced weeds have rarely spread in advance of the sheep herder or the lumberman. We are forced to the conclusion that the plants which have become weeds of the farm have spread more through the agency of man than through all the natural agencies combined. Man tills the soil, subdues the native vegetation, and creates the conditions under which plants become weeds. He also introduces and distributes the seeds, unintentionally in most cases, but nevertheless effectively.

Thus, too, our railroads are responsible for carrying many seeds. A few years ago the writer had occasion to visit Muscatine Island along the Chicago, Rock Island and Pacific Railway; for several miles along the the right of way the railroad embankment was lined with a western species of sunflower (*Helianthus petiolaris*) and in proximity to the station (Fruitland) there was quite a patch of *Tribulus terrestris* which was introduced as a ballast weed in the eastern states first and probably made its way with material that was found in the cars. Along the right of way of railroads we have seen such plants as *Salvia lanceolata*, *Argemone platyceras*, *Erysimum asperum*, *Sisymbrium altissimum*. And in the stock yards district the writer found a patch of considerable size of the sow thistle (*Sonchus arvensis*). Many other illustrations may be mentioned. Frequently, however, many of the weeds introduced by chance in this way do not persist very long. Prof. Bailey, in his book on "Survival of the Unlike" calls attention to this fact.

Yearbook U. S. Dept. Agrl. 1896: 275.



Mr. E. J. Hill called attention to a number of these waifs found in the vicinity of Chicago. Of the plants that I have mentioned as occurring in the vicinity like the western poppy, the western species of *Echinospermum* and a *Pentstemon* have not persisted. On the other hand *Salvia lanceolata* and a tumble mustard (*Sisymbrium altissimum*) have spread from their original centers.

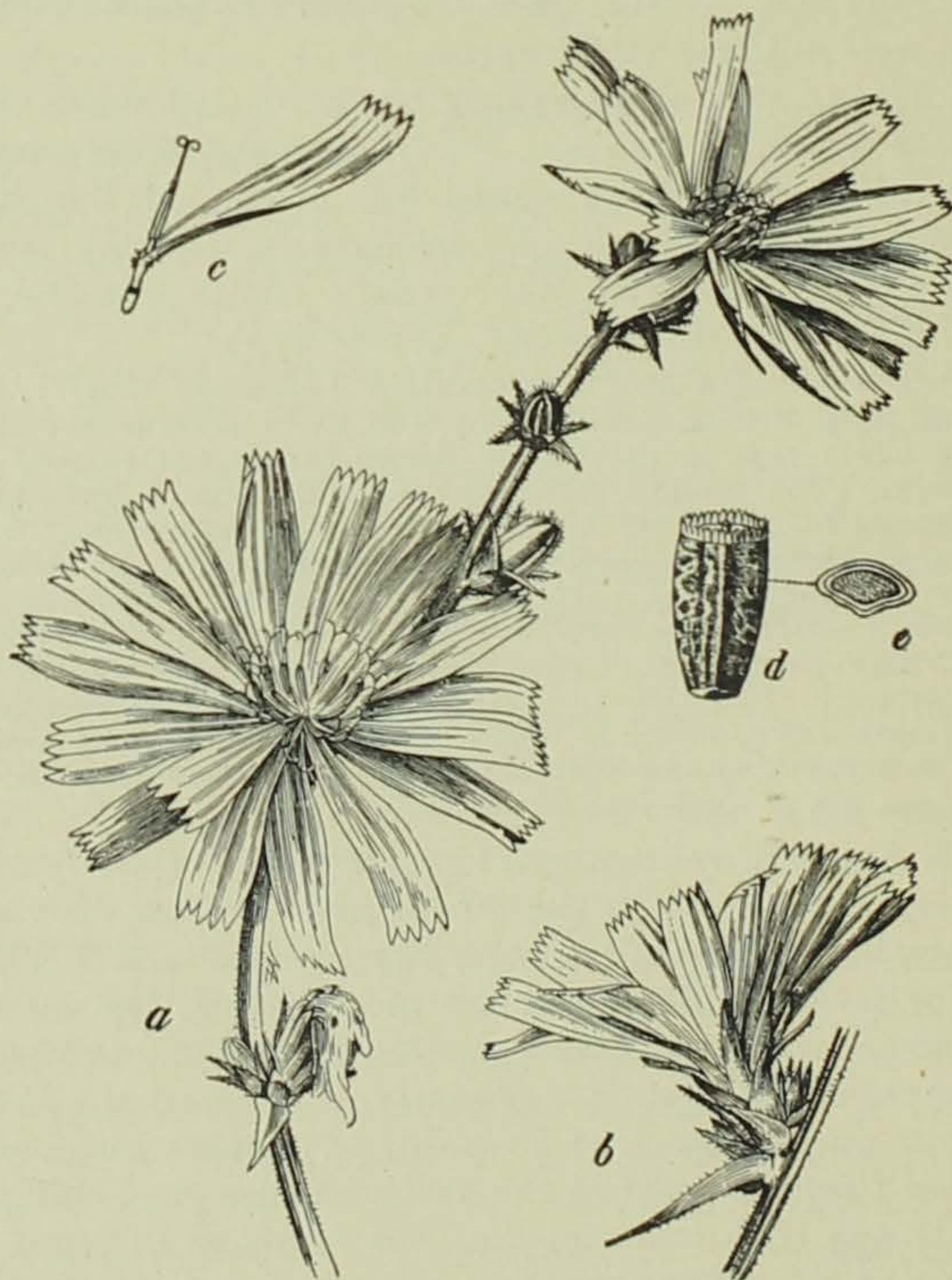


Figure 160. CHICORY (*Cichorium Intybus*). Widely distributed as a food plant, now a common weed in many parts of the United States. (U. S. Dept. Agriculture).

*Nursery stock and flowers.* It is not uncommon to find that in the vicinity of nurseries foreign weeds make their appearance. Many cases of this kind have been recorded but the writer will cite a few illustrations that have come under his own observations. Between the years 1885 and 1886 an European species of lettuce (*Lactuca virosa*) made its appearance



in the vicinity of a nursery in western Wisconsin. In eastern North America it is certainly rare although more commonly found upon the Pacific coast. Now this is a well known weed of Europe. Very likely it was introduced with some foreign shrubbery brought to the nursery.

During the month of October the writer found several large clusters of the Water Marigold (*Bidens Beckii*) in sphagnum moss in the vicinity of a nursery in Charles City. It is true this species is found in the peat bogs of Cerro Gordo and Worth counties, and here were several large clusters growing in the refuse of sphagnum on the shady side of the house. There are several well-known authentic cases of the introduction of Canada thistle in St. Louis by means of nursery stock. While thus referring to the packing of nursery stock mention may be made of the fact that weed seeds and parts of plants are frequently carried with other packing material. A few years ago the writer found growing along one of the college dormitories a great quantity of the troublesome chess (*Bromus tectorum*) which was introduced by means of packing material.

Dewey says:

The woolly mullein (*Verbascum phlomoides*), native in France, is supposed to have been introduced at Dickeys Mills, Ky., in crockery packing. Two species of long-awned chess (*Bromus tectorum* and *B. sterilis*, both European grasses, were first found at Denver, Colo., in the vicinity of a crockery store."

The writer also knows of a case in which the packing material used for crockery contained Canada thistle which was spread to a considerable distance from its original source. Mr. Dewey notes that the southern nut grass which is a most troublesome weed in the gulf states, was introduced in Arkansas with strawberry plants from New Orleans, and in southern California with orange trees from Florida. The wild onion (*Allium vineale*) has been introduced in many lawns in the eastern states with the seed used in making lawns.

*Hay and wool.*—It is also a well-known fact that in close proximity to woolen mills that various kinds of plants producing bur-like fruit make their appearance, and that these weeds make their appearance wherever this waste material is used as a fertilizer.

Hay is another frequent source for the introduction of certain weeds. In Chicago where western hay is frequently used many western plants have made their appearance and Mr. Dewey mentions that in Michigan some of the hay from Kansas and Oklahoma contained fifteen species of weeds, among



them buffalo bur (*Solanum rostratum*), the bull nettle (*Solanum elaeagnifolium*) and tumble weed (*Amarantus albus*), he likewise notes the appearance of the Canada thistle near Remington, Va., which was a supply station for Gen. Grant's army.

*Plants cultivated for ornamental purposes and as food plants.* Some of our troublesome weeds owe their introduction to their use as cultivated plants. In western Wisconsin the chicory (*Cichorium intybus*) was first cultivated as a garden plant by the Germans, thence spread to the roadsides and fields. It is likewise true for many other sections of this country. It seems to have been introduced as early as 1785 in this country when Gov. Bowdin introduced it near Dorchester, Mass.

The introduction of the ox-eye daisy in Wisconsin and



Figure 161. OLD WITCH GRASS (*Panicum capillare*) commonly scattered by man.

other western states is due to its cultivation as an ornamental plant. As early as 1880 it was so used in the vicinity of La-Cross, Wisconsin, having spread from the original locality.

Yearbook U. S. Dept. Agri. 1896: 279.



One large patch near Ames has spread in a similar way. In Europe rib grass (*Plantago lanceolata*) is recommended as a forage plant and early was so used in America. The vegetable oyster (*Tragopogon porrifolius*) owes its introduction in the eastern states, the Mississippi valley and the Rocky Mountain region to its use as a vegetable esculent.

The common purslane or pusley which was cultivated in Europe for greens owes its wide dissemination in America at least in part to its cultivation as a food. Tansy (*Tanacetum vulgare*) is common as a weed in many sections of the eastern states, largely so because it was cultivated for medicinal purposes in country gardens. In Wisconsin and Iowa it may still be seen. Elecampane (*Inula Helenium*) owes its introduction in western Wisconsin to its use for medicinal purposes. Peppermint (*Mentha piperita*) and other species were first cultivated in Michigan, Wisconsin and the other eastern states, for their medicinal properties, have spread extensively. Spinach has been widely distributed in portions of Utah and California from its earliest cultivation. Horseradish, cultivated in all parts of our country as a condimental plant has spread. The common *Euphorbia Cyparissias* and live-for-ever (*Sedum Telephium*) were widely planted in early days in cemeteries and since have spread to streets and other places. The matrimony vine, *Lycium vulgare*, widely cultivated as an ornamental climber has escaped and become a troublesome weed. The butter and eggs (*Linaria vulgaris*) was early distributed as an ornamental plant and now has become a troublesome weed in many of our northern states. Morning glories, Bladder Ketmia have similar records. The carrot, parsnip, most troublesome weeds, have spread from their use as esculent plants. So, too, celery has spread upon the Pacific coast. In Europe, the Elodea (*Anacharis Canadensis*) has become a troublesome weed, choking up water canals, introduced first as an ornamental plant. In Florida and Louisiana the water hyacinth (*Eichhornia crassipes*) is a native to tropical South America, producing clusters of blue or light colored flowers. The plant floats on the water, and where the water is shallow it may root in the mud. Dr. Webber in an interesting account of this plant shows how troublesome it has been to the navigation of the St. John's river in Florida, and Louisiana as well as the fishing and lumber industries.



## POLLINATION OF A FEW WEEDY PLANTS

It may be of interest to briefly give an account of the pollination of some of the common weeds.

The pollination of the common milkweed has been studied by a great many investigators, among them Hildebrand and Mueller. The pollination of the plant is of some interest because the pollinia are so abundantly found on the bee, that it is imprisoned. The deeply five-parted corolla is of purple color. Next to the corolla is a crown of five-hooded bodies seated on

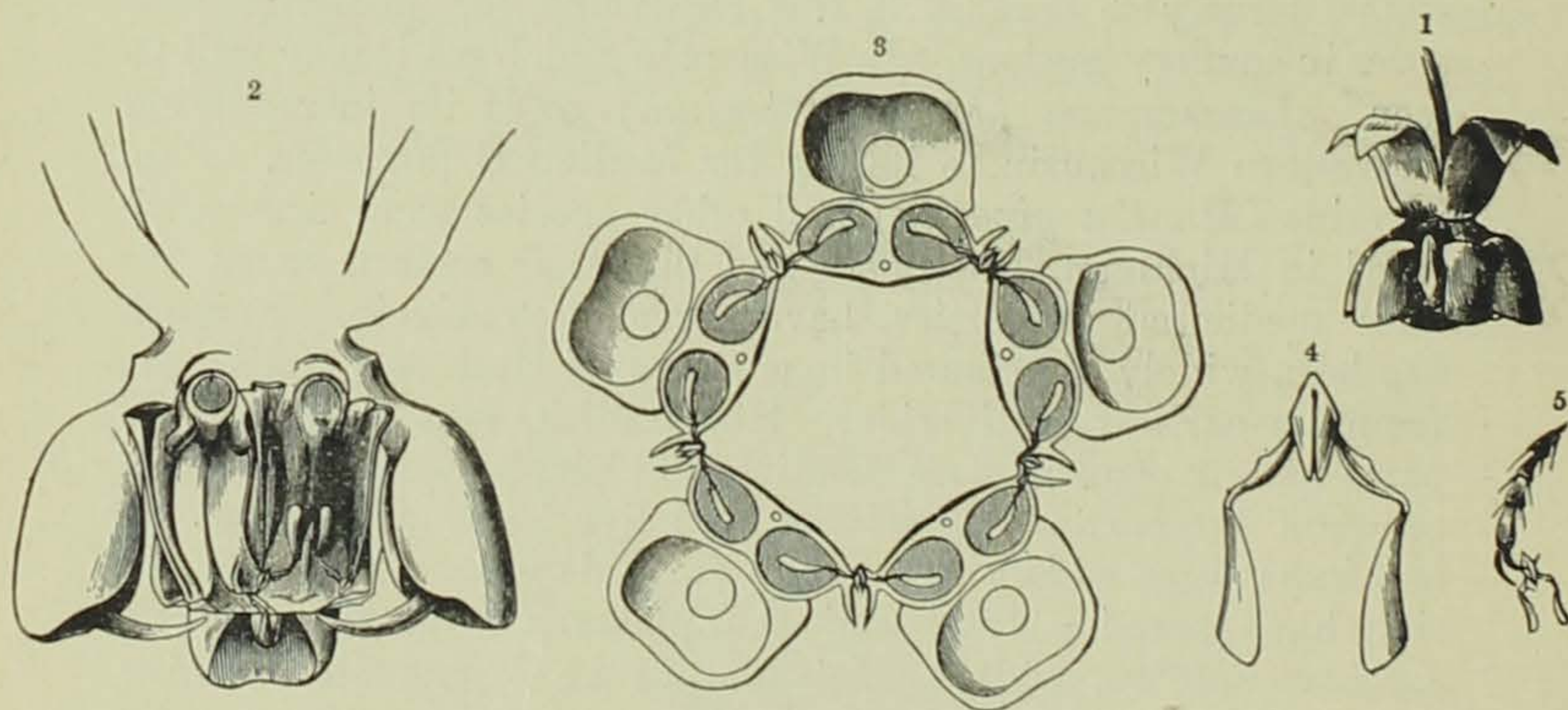


Figure 162. POLLINATION OF COMMON MILKWEED. 1. Side view. 2. Same view the two staminate appendages and front view of another cut away, cross section of same flower. 4. Corpusculum with two pollinia. 5. Foot of an insect with pollinia fastened to it. (Kerner-Oliver).

the stamens. The five stamens are attached to the corolla, the filaments are united in a tube which encloses the pistil, and the anthers adhere to the stigma. Unlike the pollen of orchids, milkweed always has a pair of pollinia. They are pear-shaped and of yellow waxy appearance. They hang by a curved stalk from a dark colored disc. These pollen masses are taken out by insects as they suck the nectar from the glands. The pollinia are attached to the insect's hair, legs and tongue. Charles Robertson, in an excellent account of plants belonging to this family, finds that in *Asclepias verticillata* the pollinia are usually attached to hairs of insects. In *Asclepias cornuti* the pollinia are more frequently attached to the claws. It is dangerous for small insects to extract the pollinia and insert them into the stigmatic chamber. In one day Mr. Robertson picked thirty-four dead hive bees from flowers. The feet become entangled



with the pollen masses. In another species, *A. Sullivantii*, he states that in a small patch bearing fifty-two follicles one hundred and forty-seven dead bees were found. In a single umbel he has often found four, and in one case seven, dead hive bees (Hymenoptera), butterflies and moths (Lepidoptera), flies (Diptera), a few Coleoptera and Hemiptera. Some of these visitors are useless since they do not light on the flower. Others cannot extract the pollinia. Humming birds have been observed, but Mr. Robertson thinks they are useless.

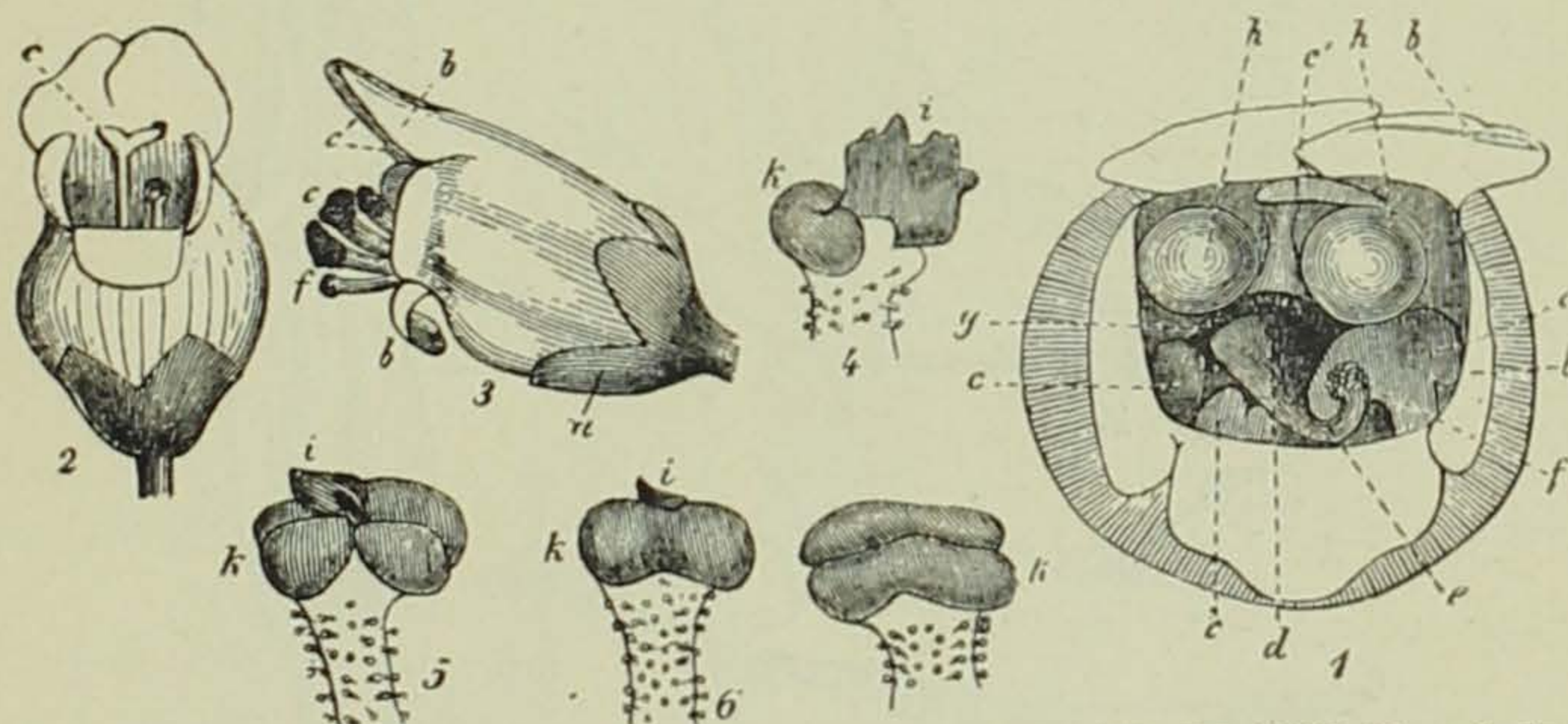


Figure 163. POLLINATION OF SIMPSON HONEY PLANT (*Scrophularia nodosa*). 1. Flower in first stage from the front. 2. Same from below. 3. Older flower capable of self-pollination. a. Calyx. b. Corolla. c. Stamen. c'. Fifth metamorphosed stamen. d. Ovary. e. Style. f. Stigma. g. Nectary. h. drop of honey. 4-7. stamens in various stages of reversion to their original form. (Mueller).

Plants of the order Convolvuiaceae are not abundant in Iowa. Most abundant is the common Morning Glory (*Convolvulus sepium*). The flowers are large and white. It is without odor nor has it any pathfinders. It opens during the early morning and is not abundantly visited by insects. Hermann Mueller states that on dark evenings he found it closed between 9 and 10 o'clock, but open on moonlight evenings. Its distribution in Europe is supposed to be dependent on *Sphinx Convolvuli* but Mueller records a number of other visitors and Robertson reports a number of *Apidae*.

The *C. arvensis* has become a common weed in places. It has a funnel-shaped, white or red corolla with a yellow base on the inside and five radiating white streaks which are the pathfinders. The flower closes in the evening and rainy weather and is therefore adapted to diurnal insects.

*Scrophularia nodosa* L. var. *Marylandica*, Gray.—Prof. Trelease has given us an interesting account of the pollination of this plant. It is especially adapted to wasps. Mueller records



6 Vespidae. He says: "The fact that they hold a proportion of over one-third in the list of Scrophularia is sufficient evidence that the flower especially favors wasps. I know of no bee flower on which so many wasps occur as intruders." It is frequently visited by hive bees.

The small-greenish-purple, irregular flowers are proterogy-

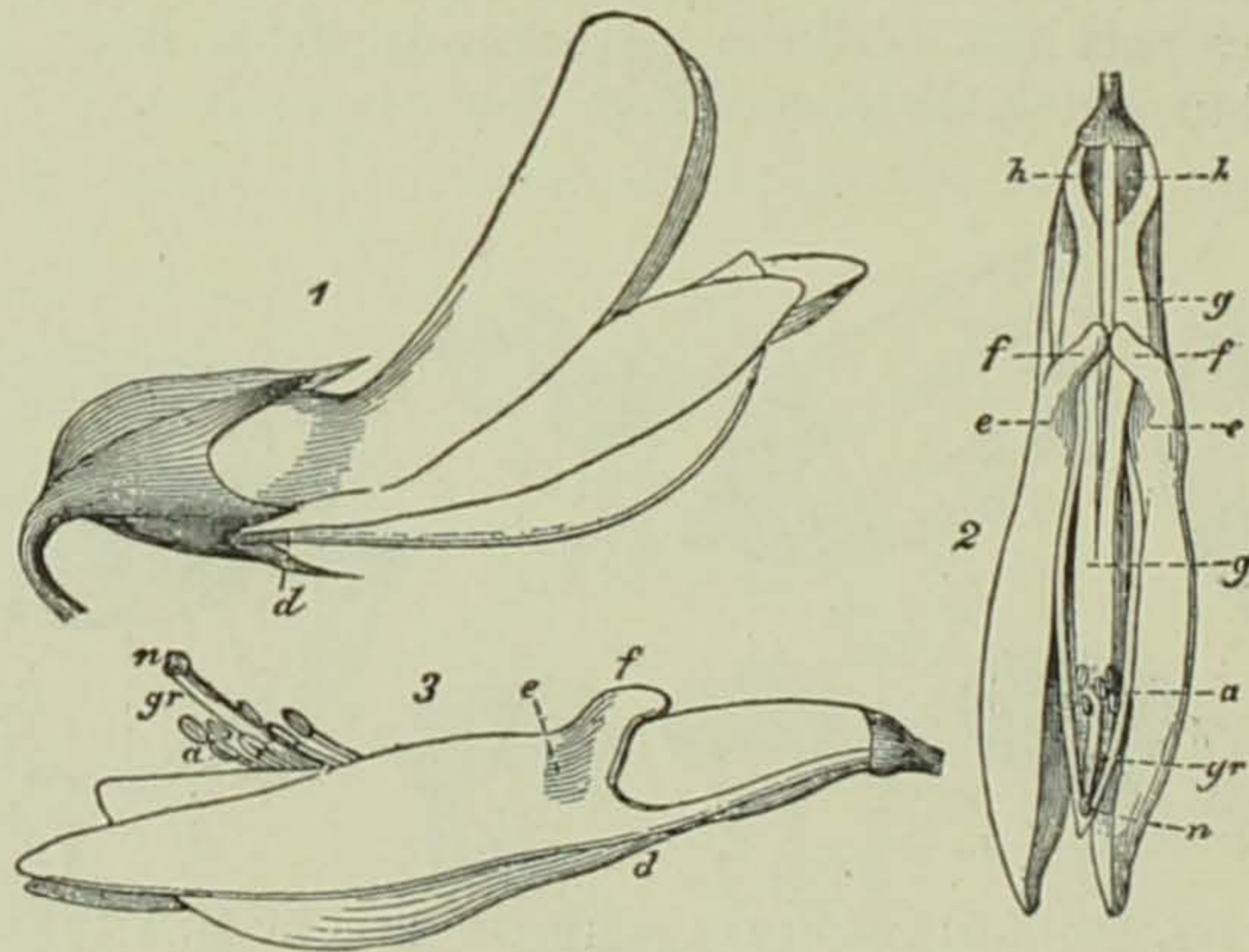


Figure 164. POLLINATION OF SWEET CLOVER (*Melilotus alba*). 1. Flower from side. 2. Flower, from above, after removal of calyx and standard. 3. Flower, from the side, after depression of the wings and keel. a, anthers; d, point of flexure of keel; e, depressions in wings; f, digitate processes; g, column; hh, entrance to honey; gr, style; n, stigma. (Mueller).

nous. In its earlier stages the stigma only protrudes, it is inclined over the lobe. Honey bees and wasps which largely pollinate the flowers, approach them from the front, come in contact with the stigma leaving some of the pollen on it. The following day the stamens come in view and the style becomes flabby and rests on the lower lip. An insect in going to the flower for the nectar is dusted with pollen from the later flowers. Self-pollination cannot occur.

Mustard (*Brassica nigra*, Koch.—Common mustard is a wayside and garden weed. The yellow flowers are conspicuous, arranged in masses, and have a pleasant odor. It has four nectar glands, two outside at the base of the petals and two in front of the short stamens. The nectar occurs in large drops on the glands where it is taken by the insect which in doing so comes in contact with the pollen on both long and short stamens, leaving some of the pollen on the capitate stigma. In the absence of cross-pollination, self-pollination occurs.



Sweet Clover (*Melilotus alba*.)—White flowers, small, massed in racemes, often one-sided. The flowers are papilionaceous; calyx short; standard obovate or oblong; the keel obtuse. This plant is adapted to pollination by bees. In some of our western states as Colorado a very large portion of the honey

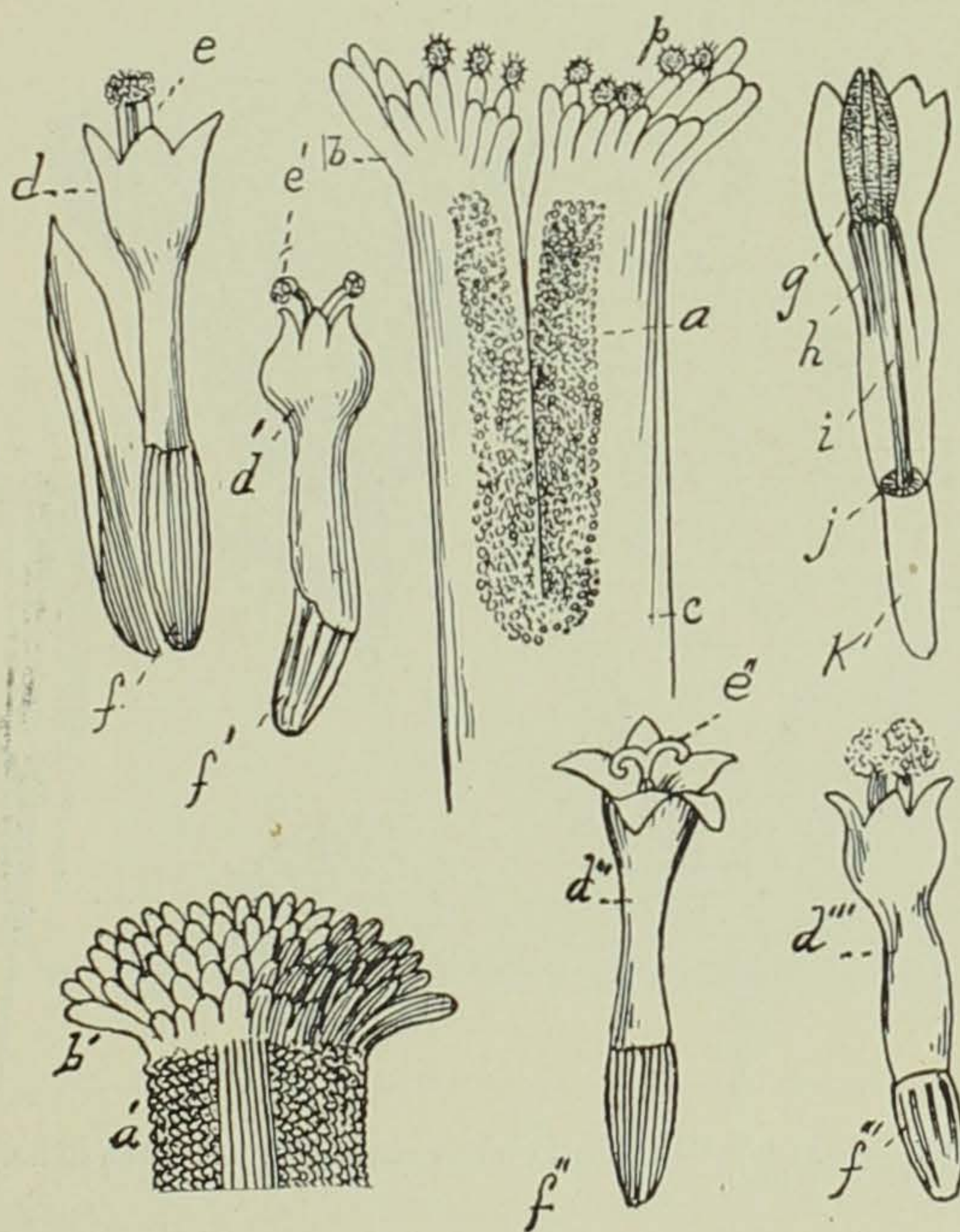


Figure 165. POLLINATION OF YARROW (*Achillea millefolium*). a, stigmas and style; b, brush hairs and pollen; p, g, the syngenesious anthers; k, ovary; d, corolla; e, style protruding from anther tube; e', a, later stage; e'', end of pistil reflexed; b', brush hairs; a', stigmatic papillae. (Mueller).

produced is obtained from the flowers of this plant. In general adaptations to pollination are much the same as those of the white clover (*Trifolium repens*). The flowers are sweet scented; the nectar is secreted at the base of the stamens and an insect in order to reach the nectar puts his proboscis underneath the standard. It uses the wings and keel as a resting place, pressing down the latter and causing the stamens and pistil to protrude. They come in contact with the lower surface of the body and thus cross pollination is effected.



Evening primrose is a common weed. It is adapted to nocturnal Lepidoptera; but also to long tongued bees. The flowers are bright yellow open partially during the day but produce the greatest amount of odor during the evening. Trelease has observed that the *Oenothera sinuata*, L. is visited by the hum-

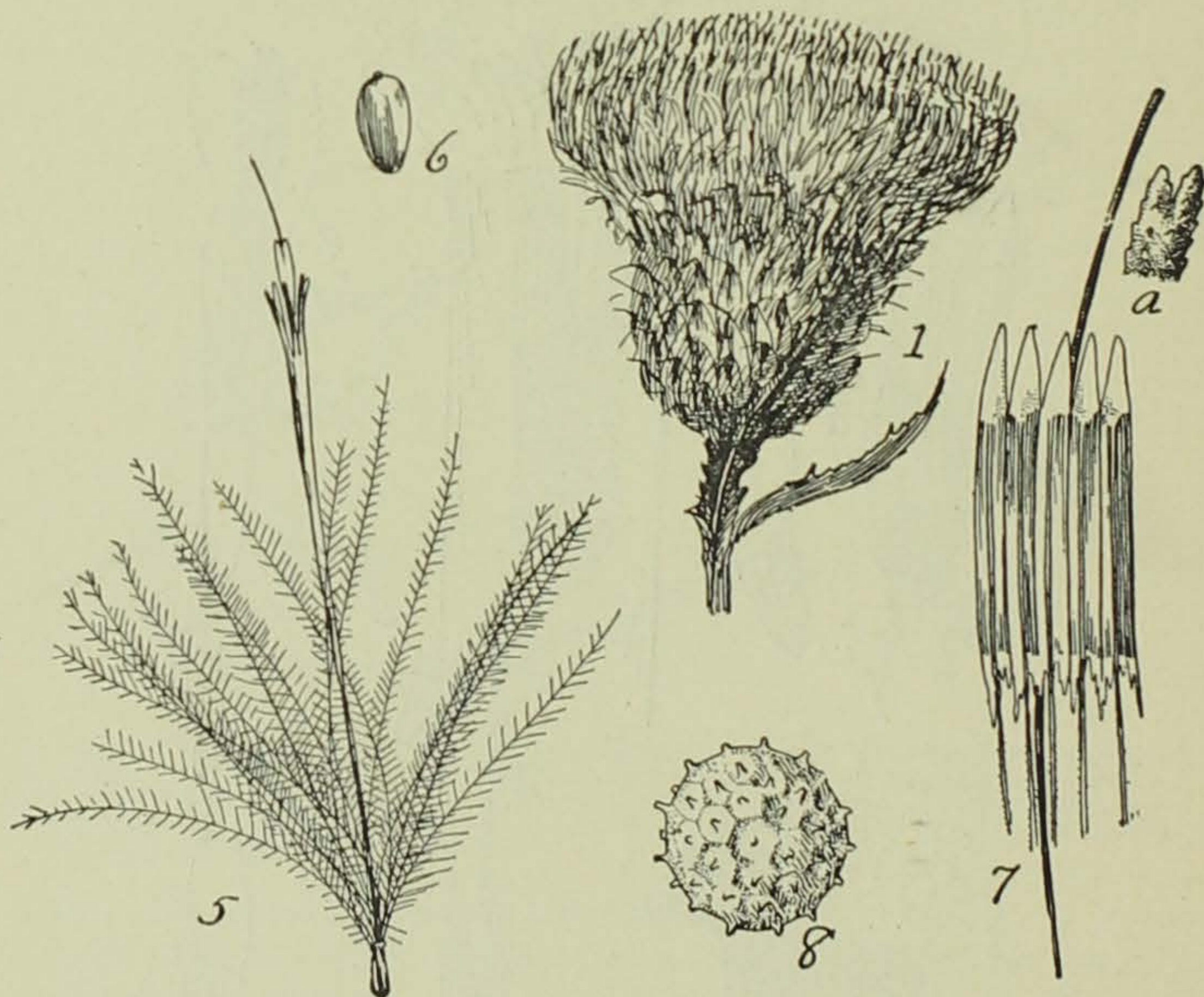


Figure 166. WOOLLY THISTLE (*Cnicus canescens*). Common in northwestern Iowa. (Charlotte M. King).

ming bird. Some species of *Oenothera* produce cleistogamous flowers.

In yarrow or milfoil (*Achillea millefolium*) the white heads are attractive to insects. A single flower is small and inconspicuous, but many of these small flowers are crowded together in one head, and in addition the white ray-flowers certainly render them conspicuous. The nectar is easily reached by many insects. It is secreted by a small disc at the base of the style. The flowers are strongly appressed in a cylinder made by the five anthers. The anthers when mature, shed their pollen into the hollow cylinder. The tips of the lobes of the style are furnished with hairs and as the style elongates it brushes the pollen out which remains attached to the hairs. When older, these



branches turn back and an insect going to the flower cannot help but get some of the pollen on the stigma. While cross-pollination is almost certain to occur, self-pollination and self-fertilization may also occur.

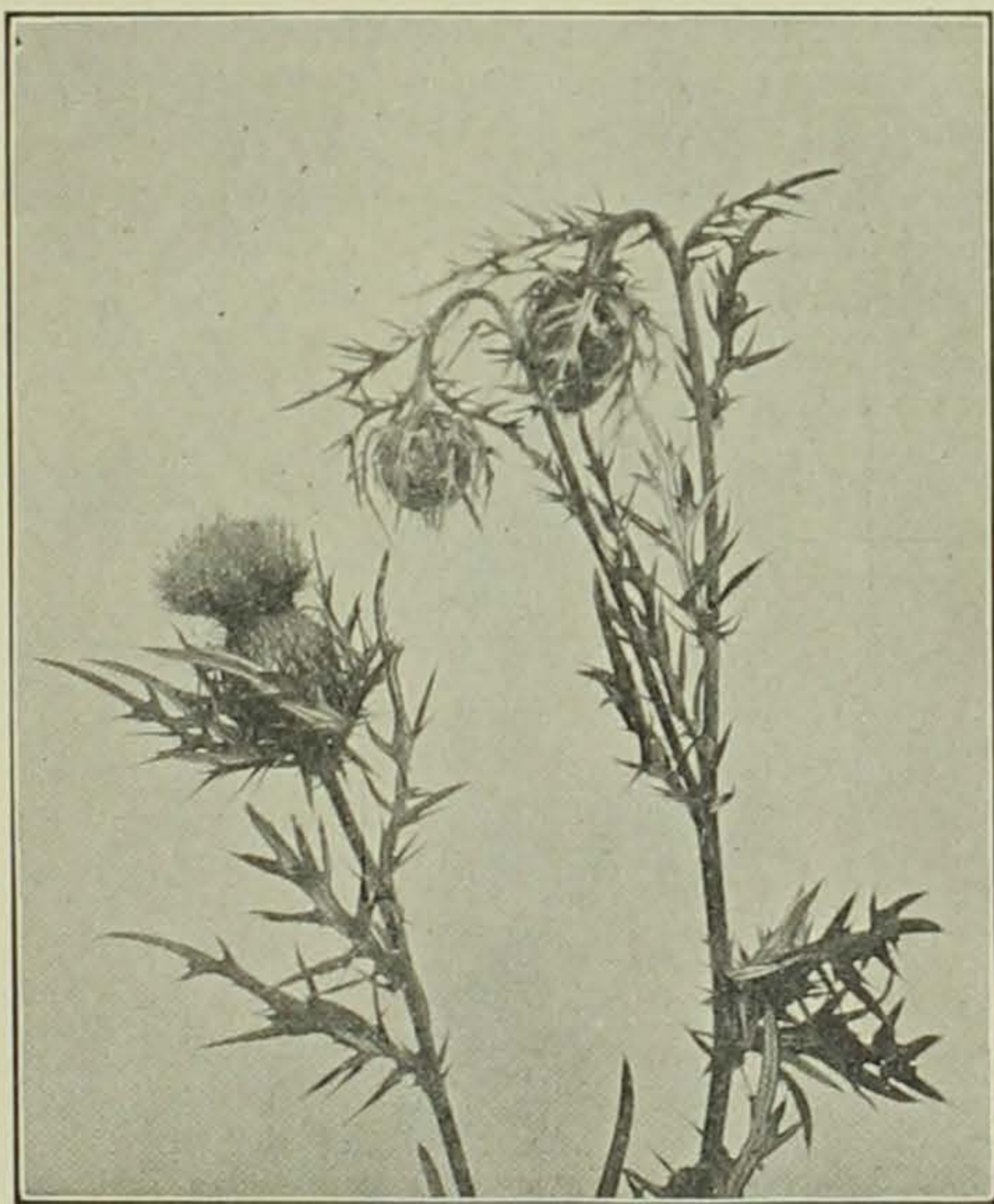


Figure 167. POLLINATION OF THISTLE (*Oniscus discolor*).

Bull Thistle.—Bull thistle (*Cnicus lanceolatus*) is common in pastures and is rendered conspicuous because the purple flowers are collected in heads. It is strongly proterandrous. In the first stage a large quantity of pollen is pushed out by the style from the opening of the syngeneis anthers. When the style occurs outside of the anther tube a bunch of hairs may be seen, known as brush hairs. These not only help to take out pollen but prevents it from falling to the bottom of the tube. The pollen grains are spiny which causes them to adhere not only to the insect but to the hairs on the style as well. The slightly swollen anthers show spontaneous movements and because of the shortening a mass of pollen is thrown out. This happens when an insect seeks the nectar which is secreted by a ring surrounding the base of the tubular corolla, as it is in all other Compositae. In



the latter stage the pistil has protruded showing the stigma. If the pollen has not been carried away by the insect self-pollination may occur.



Figure 168. POLLINATION OF JIMSON WEED (*Datura Stramonium*). This flower is adapted to night flying insects. (U. S. Dept. of Agriculture).

Bull thistle, flowers with us from the latter part of July to September and is visited by many worker bumble bees. Mr. Weed says: "But they are not the large and handsome bees found in the Arbutus in May—they are much smaller in size and less attractive in appearance. The large specimens which appear in spring are the hibernating females or queens. In addition to bees many Diptera occur, especially syrphus flies (Lepidoptera). The *Colias philodice* as well as *Pieris*, *Danais archippus* and *Papilio turnus* visit the thistle flowers.

Our native (*Cnicus discolor*) is equally interesting. In dandelion (*Taraxacum officinale*) the numerous flowers are collected in a head. All of the flowers of the head are alike and bright yellow. The head is open in bright sunlight of the



early morning and partially closed about noon. When fertilized the "flower stem" contracts, ripens its "seed," and elongates when ripe, so that the "seed" may be distributed. An abundance of nectar is produced which rises up for a considerable distance in the tube, making it accessible to many insect visitors with short tongues. The honey bee is a very common visitor as are also species of *Bombus*. Many Diptera (*Syrphus* flies) visit it. Mueller records 67 Apidae, 7 Lepidoptera, 25 Diptera and 16 other insects. In the Alps Lepidoptera preponderated over the Apidae.

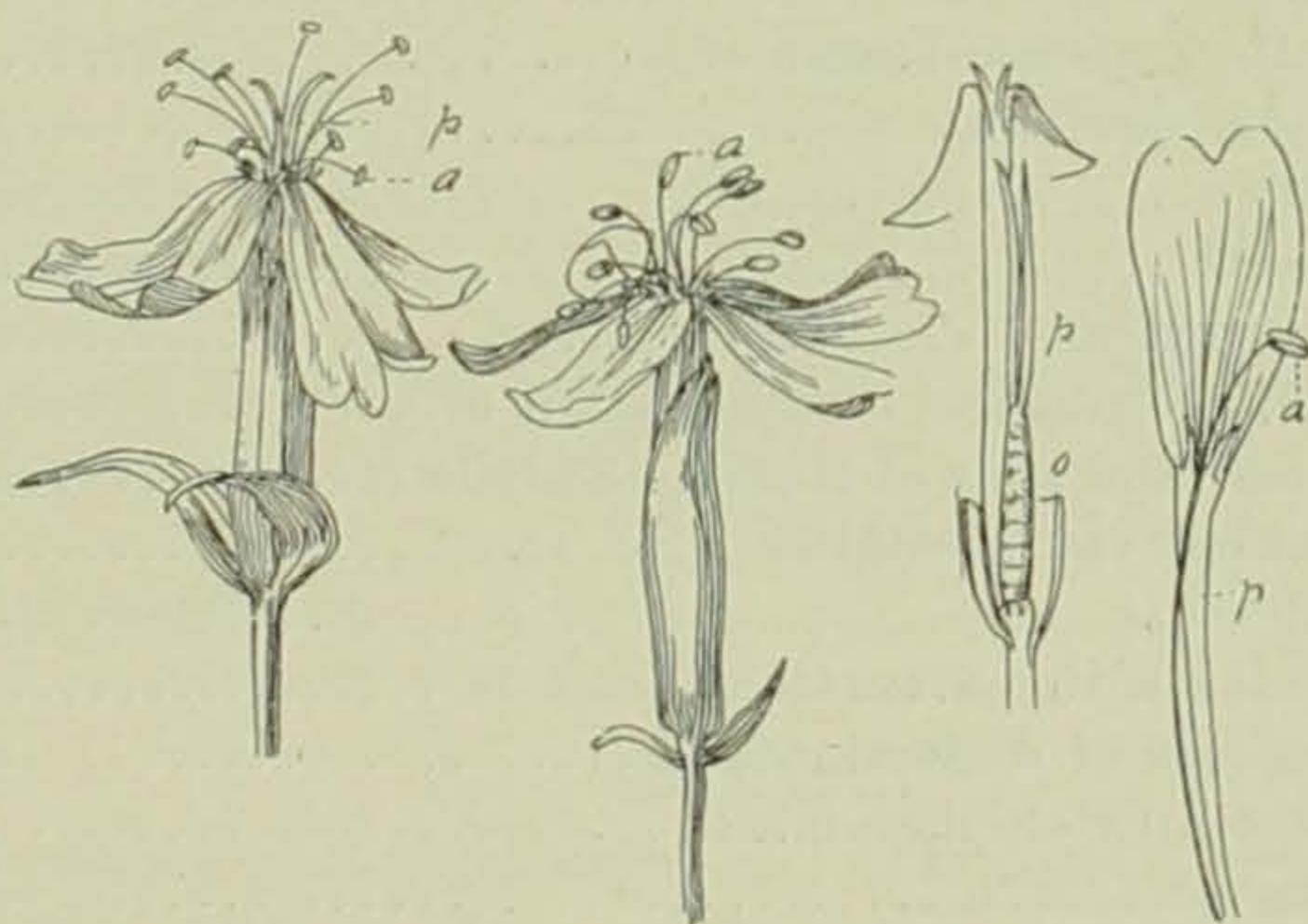


Figure 189. POLLINATION OF BOUNCING BETTY (*Saponaria officinalis*). Middle figure showing first stage, anthers dehiscing; to the left, the anthers have dehisced, the two styles spread apart. To the right a single petal with long claw, crown and anther; to the left a single petal with pistil, the ovary at *o*; the crown above and the slightly reflexed spreading limb *b* of the petal. (Charlotte M. King).

Jimson Weed.—*Datura Stramonium*.—The Jamestown weed is a large, coarse annual with a white corolla about three inches long and stamens adherent to the corolla tube for a part of the distance then leading inwards, thus effectually excluding from the honey so that only Sphingidae can obtain it. Mr. Robertson reports that honey bees remove the pollen as soon as the flower is open, before the flight of *Deilephila lineata*. A Venezeulan species of *Datura* is visited by *Dosimastes ensifer*, the female of which has a beak 8 cm. long, and the male one 10 cm. in length, these corresponding to the tube of the corolla.



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